Cornell University Library
HD 5119.C7N3
Hours of work as related to output and h
3 1924 001 689 276

Hours of Work as Related to Output and Health of Workers

COTTON MANUFACTURING

Research Report Number 4
March, 1918

National Industrial
Conference Board

THE LIBRARY
OF THE
NEW YORK STATE SCHOOL
OF
INDUSTRIAL AND LABOR
RELATIONS

AT
CORNELL UNIVERSITY

HOURS OF WORK AS RELATED TO OUTPUT AND HEALTH OF WORKERS

Cotton Manufacturing

RESEARCH REPORT NUMBER 4
MARCH, 1918

Copyright 1918

NATIONAL INDUSTRIAL CONFERENCE BOARD
15 BEACON STREET
BOSTON, MASS.

The original of this book is in
the Cornell University Library.

There are no known copyright restrictions in
the United States on the use of the text.

http://www.archive.org/details/cu31924001689276

CONTENTS

PAGE

FOREWORD vii

INTRODUCTION 1

STATISTICAL BASIS OF THIS REPORT 1

GENERAL FEATURES OF THE COTTON MANUFACTURING INDUSTRY 3

PRINCIPAL PROCESSES IN COTTON MANUFACTURE . . . 5

PRESENT HOURS OF LABOR IN COTTON MILLS 11

SATURDAY HALF HOLIDAY 12

NOMINAL AND ACTUAL HOURS 13

TIME ACTUALLY SPENT IN PHYSICAL EFFORT . . 13

HOURS AND OUTPUT — NORTHERN MILLS 15

ESTABLISHMENTS MAINTAINING PRODUCTION UNDER SHORTER HOURS 17

ESTABLISHMENTS REPORTING A DECREASE IN OUTPUT UNDER SHORTER HOURS 19

IMPORTANT FACTORS BEARING ON EFFICIENCY

MACHINE TIME FEATURE OF WORK 20

SIZE OF ESTABLISHMENT 23

INFLUENCE OF PIECEWORK SYSTEM 24

ATTITUDE OF WORKERS 25

ATTITUDE OF NORTHERN MANUFACTURERS TOWARDS A 54-HOUR WEEK 25

HOURS AND OUTPUT — SOUTHERN MILLS 28

STATISTICAL DATA AS TO OUTPUT

DIFFICULTIES OF SECURING COMPARABLE DATA . . . 31

OUTPUT COMPARISONS 33

COMPARISON OF OUTPUT AT A NORTHERN SPINNING MILL 33

COMPARISON OF OUTPUT OF A WEAVING ROOM OF A NORTHERN MILL 35

COMPARISON OF OUTPUT AT A NORTHERN PIECE GOODS MILL 36

COMPARISON OF OUTPUT AT A MILL WHERE THE CHARACTER OF THE PRODUCT WAS LESS UNIFORM . . 37

OTHER COMPARISONS 40

COMPARISON OF OUTPUT OF THREE WORKERS UNDER VARYING SCHEDULES 41

IMPROVEMENTS IN EQUIPMENT FOLLOWING REDUCTIONS IN HOURS 43

CONCLUSIONS AS TO OUTPUT DATA 43

Hours and Health of Workers PAGE
Difficulties of the Problem 45
General Lack of Statistical Data 45
General Health of Cotton Mill Workers 46
Reports of Massachusetts State Board of Health 46
Metropolitan Life Insurance Company's Sickness Survey in North Carolina 49
Leipzig Insurance Fund Data 50
Mortality Statistics 51
United States Census Data 51
Reports of United States Bureau of Labor . . . 53
Summary of Health Data 55
Accident Hazard in the Cotton Industry 56

Summary and Conclusions 57

Appendix — Individual Replies of Manufacturers
Northern Mills 59
Southern Mills 63

LIST OF TABLES

PAGE

TABLE 1: Geographical Distribution of Establishments Replying to the Schedule of Inquiry, 1917 2

TABLE 2: Number and Percent of Establishments Replying to the Schedule and Number and Percent of Employees, Grouped According to Prevailing Hours per Week, 1917 . . 12

TABLE 3: Number and Percent of Northern Establishments Replying to the Schedule and Number and Percent of Employees, Grouped According to the Effect on Output Accompanying Reduction in Hours 15

TABLE 4: Average Hours After and Before Reduction, and Average Reduction in Hours of Northern Establishments Replying to the Schedule, Grouped According to Effect which Accompanied Reduction 16

TABLE 5: Number of Northern Establishments Replying to the Schedule and Number of Employees, Grouped According to Present Hours and the Effect on Output Accompanying Reduction of Hours 16

TABLE 6: Principal Products, Number of Employees, and Hours After and Before Reduction, in Six Northern Establishments which Reported that Production Was Maintained When Hours Were Reduced 17

TABLE 7: Number and Percent of Northern Establishments which Reported Effect on Output Accompanying Reduction in Hours, Grouped According to Effect and to Number of Employees 23

TABLE 8: Number and Percent of Southern Establishments Reporting Reduction in Hours and Number and Percent of Employees, Grouped According to the Effect on Production Accompanying Reduction in Hours 28

TABLE 9: Average Hours After and Before Reduction, and Average Reduction in Hours of Southern Establishments Reporting Reductions in Hours, Grouped According to Effect on Output which Accompanied Reduction 29

TABLE 10: Comparison of the Average Output per Spindle per Week, for a Northern Spinning Mill, for a Six-Months Period ending April 29, 1916, under a 58-Hour Week, with that for a Similar Period ending April 28, 1917, under a 54-Hour Week 34

PAGE

TABLE 11: Comparison of the Output of a Weaving Room in a Northern Mill for May, October, and August, 1911, under Weekly Schedules of 56, 54, and 51¼ Hours, Respectively 35

TABLE 12: Comparison of Output of a Northern Cotton Mill Making Piece Goods under a 60-Hour Schedule with that under a 54-Hour Schedule, 1912 36

TABLE 13: Comparison of Output of a Northern Cotton Mill Making Piece Goods, under Work Schedules of 58, 56, and 54 Hours per Week 38

TABLE 14: Rate of Sickness per Thousand Exposed of all White Persons; White Persons Exclusive of Textile Workers; and Textile Workers Only, in a Survey Made by the Metropolitan Life Insurance Company in North Carolina for Week of April 17, 1916 49

TABLE 15: Average Number of Days of Sickness per Hundred Members of the Local Sick Benefit Society of Leipzig, 1887–1904, by Leading Occupations 51

TABLE 16: Percentage of Deaths of Males Due to Certain Causes, for Cotton Mill Operatives and for Workers in All Manufacturing and Mechanical Pursuits, by Age Groups. U. S. Census Mortality Statistics, 1909 52

TABLE 17: Comparative Compensation and Liability Insurance Rates in Cotton Manufacturing and Various Other Industries, in Massachusetts, 1917 56

Foreword

THE National Industrial Conference Board is conducting an investigation into the relationship between different hours-of-work schedules, efficiency of production, and health of workers. The basis of this study is the experience of employers in the principal industries of the country. The data are being obtained in part through formal questions and in part through personal field study by the Board's experts.

The purpose of the investigation is to establish the facts of this controversial subject and to present such conclusions as are clearly warranted by a scientific analysis of these established facts. The investigation was not undertaken with the intention of attacking or defending a workday of any specific length, but instead to assemble the available results of actual experience with various hours-of-work schedules.

The discussion of hours of work should be sharply distinguished from that of a basic workday. The latter is primarily a wages problem, but is often confused with the problem of determining what number of hours of work per day or per week will be most productive without impairing the health of workers.

Conclusions as to the proper length of workday, moreover, must take into account not only the effect on output and on health, but also the need of the worker for a reasonable period of leisure for recreation, home life, and self-development.

The problem varies so widely in different industries — because of differences in type of worker, in character of product, in management, and particularly in the extent to which automatic machine processes influence results — that the experience of any one industry must not be taken as representative of industry in general.

On account of the timeliness of the subject, the report will be issued in sections, one for each major industry, as rapidly as the necessary information can be assembled and analyzed. The first section, presented herewith, deals with experience in the cotton manufacturing industry.

Hours of Work as Related to Output and Health of Workers

COTTON MANUFACTURING

INTRODUCTION

This analysis presents the essential facts gathered in the course of an investigation of experience with reductions in hours of work in the cotton manufacturing industry. The principal purpose of the study was to determine the effect of such reductions in work-hours on output and on the health of workers. The data were gathered in part by means of schedules of inquiries addressed to members of the National Association of Cotton Manufacturers and of the American Cotton Manufacturers' Association, and in part by field investigation covering both employers and representatives of labor.

STATISTICAL BASIS OF THIS REPORT

Replies to the schedule of inquiry were secured from 166 manufacturers, employing 116,000 workers. A classification, by states, of establishments[1] making standard lines of product,[2] and of employees follows.

[1] Throughout this report the word "establishment" is used to designate a corporation, partnership, or individual submitting a schedule. When a single management operating several plants returned a consolidated schedule, this is necessarily treated as one establishment. The terms "operatives," "employees," etc., designate all factory employees, but do not include office, sales, or engineering forces.

[2] Returns from bleaching and dyeing, and from other establishments whose product was not characteristic of the industry proper (for example, elastic webbing) have been excluded from the statistical compilations in this report.

TABLE 1: GEOGRAPHICAL DISTRIBUTION OF ESTABLISHMENTS REPLYING TO THE SCHEDULE OF INQUIRY, 1917.[1]

(National Industrial Conference Board.)

	Establishments	Employees
Northern Mills		
Total	109	82,036
Maine	6	3,794
New Hampshire	5	5,662
Vermont	1	263
Massachusetts	55	46,067
Rhode Island	12	11,063
Connecticut	11	4,117
New York	6	3,126
New Jersey	2	1,487
Pennsylvania	8	4,590
Maryland	2	1,622
Indiana	1	245
Southern Mills		
Total	57	34,347
Virginia	1	5,895
North Carolina	18	8,777
South Carolina	11	5,685
Georgia	11	6,912
Alabama	6	3,426
Kentucky	1	384
Tennessee	2	941
Mississippi	2	885
Louisiana	1	600
Oklahoma	1	90
Texas	3	752

In addition to the information received through replies to the schedule, many northern cotton establishments were visited by field investigators. Six of these, which did not file schedules, employed approximately 21,000 operatives; therefore the investigation covers approximately 103,000 northern workers. This is about 48% of the total for this section as reported by the U. S. Census of Manufactures (1914).

Ninety-five northern establishments reported that they had reduced hours within recent years. A substantial basis of experience with such reductions is therefore available. Because of new methods of management, shifting of race of workers, and other fundamental changes since the last reduction in hours (which in many cases occurred in 1912), it was necessary to compare results for periods shortly before and after the change in hours.

[1] In a very few cases the figures are for 1918.

On account of the rather small number of southern establishments which replied to the schedule, and the fact that as yet the Board has made no field study in the South, results for these are somewhat tentative. Such data on output as were obtained from southern mills are treated in a separate chapter.[1]

GENERAL FEATURES OF THE COTTON MANUFACTURING INDUSTRY

In a study of the hours-of-work problem in cotton manufacturing several distinctive characteristics of the industry should be pointed out.

1. *Automatic nature of the work.* A visitor in a cotton mill is at once impressed by the great amount of machinery as compared with the number of workers. In a weaving room, for instance, there are long rows of looms, with an operative for perhaps every six to twenty looms. In a spinning room a single operative tends to the frames on both sides of an aisle, sometimes taking care of as many as a thousand spindles. Many rooms have a more or less deserted appearance, and operatives often will be seen seated for several minutes at a time at some distance from their machines. These conditions are in sharp contrast to those in most factory industries. In a shoe factory, for instance, practically every machine has an operator and one is impressed by the large number of workers and their almost constant manipulation of the material in hand.

This "machine tending" feature of the work in a cotton mill is one of the most distinctive characteristics of the industry and one which has a vital bearing on the hours-of-work problem. Not only is the work highly automatic, but much of it is very light.

2. *Heavy investment required.* A modern cotton mill of any considerable size represents a very heavy investment, often running into several millions of dollars. This, of course, has an important bearing on the hours-of-work problem, since overhead expense per unit of product increases rapidly if total output is reduced.

3. *Speed of machinery.* Cotton spindles frequently make from eight thousand to ten thousand revolutions per minute and still higher speeds are not uncommon. Al-

[1]See page 28.

though weaving machinery is operated at a slower rate, high speed of machinery is a feature of the cotton manufacturing process as a whole. This may, of course, have a direct bearing upon the hours-of-work problem, but clear distinction should be made between speed of machinery and speeding of the operative. An attendant feature of this speed is the noise which characterizes many of the processes, especially weaving.

4. *Proportion of women workers.* Another feature of the industry is the extensive employment of women and minors. In the establishments submitting replies to the schedule, the composition of the working force was as follows:

	Northern Mills		Southern Mills	
	Number	*Percent*		
Total	82,036	100.0	32,036[1]	100.0
Men	43,845	53.5	19,297	60.2
Women	34,656	42.2	10,545	32.9
Boys	1,860	2.3	1,204	3.8
Girls	1,675	2.0	990	3.1

The percentages above given agree closely with those of the United States Census of Manufactures (1914), which showed that of 393,404 wage-earners employed in the cotton goods industry, 38.2% were women and 53.4% men. The census percentage for minors was 8.4.[2]

5. *Wages.* Wages have been relatively low. From compilations made from the United States Census of Manufactures (1914) it appears that the average annual earnings of workers in cotton mills were 33% less than the average for workers in twenty-three leading industries. It must be remembered, however, that owing to the automatic character of the operations, the mass of cotton mill workers represent a rather unskilled grade of labor. Since 1914, wages have, of course, increased rapidly in cotton manufacturing, as in other industries.

---

[1]Excludes 2,311 employees in one establishment which did not furnish details.

[2]The difference in the percentage of minors reported is largely due to the fact that the census figures were influenced by the southern cotton industry, where the percentage of minors was relatively high. The percentage of minors and women employed in the cotton industry has decreased in recent years. Furthermore, the actual number of minors has decreased; the actual number of women, however, has increased.

The number and percentage of minors has presumably been further reduced recently as a result of the Federal Child Labor Law, which went into effect on September 1, 1917.

6. *Changes in race of workers.* The nationality of northern cotton mill operatives has shifted considerably in recent years. The proportion of American, Scotch, and Irish workers has greatly decreased and even French Canadians, who ten years ago made up a large percentage of the employees in cities like Fall River and Lowell, have been extensively replaced by Greeks, Syrians, and the Slavic races of middle Europe. This shifting in races of workers, in some cases at least, has been accompanied by a deterioration in average efficiency. Where comparisons of output are made for periods directly before and directly after a reduction in hours, however, this consideration does not appreciably affect results.

PRINCIPAL PROCESSES IN COTTON MANUFACTURE

The elaborate machinery required in the manufacture of cotton goods forbids anything approaching a technical description of processes in this report. Brief mention will be made of major processes, with special reference to the amount of physical exertion required of workers and to certain health hazards involved.

Opening and Picking. In the opening and picking departments, the bales of cotton are broken open, the grades mixed, and the staple thrown into the opener — a cylindrical apparatus with teeth — which loosens up and beats the fiber, removing dirt, leaf, and seed. A system of suction fans at the same time removes much of the dust. From the opener the cotton is fed into a lapper, which, after further cleaning, leaves it in the form of wide sheets or laps, rolled loosely into cylindrical shape.

In the main these operations are performed by machinery and the comparatively few operatives required are nearly always men. In some mills mixing is done by hand, and in such cases the workers pick up the cotton in armfuls, break it into smaller masses, and at the same time mix it.

Except in the handling of the bales of cotton, the work in the opening and picking departments is not heavy, but the operatives are constantly employed. A feature is the frequent cleaning of the machinery. The processes are very dusty, but in most modern mills the use of exhaust systems has greatly reduced this hazard.

Carding. In carding machines, cylindrical rolls covered with wire teeth further clean and straighten the staple and remove much of the short fiber. In the most common type of carding machinery the cotton comes off in the form of an extremely thin web several feet wide, and is immediately drawn through a funnel-shaped apparatus into loose, narrow strands called slivers. The slivers are coiled by automatic machinery in tall cans like an ordinary coil of rope, except, of course, that the fiber is extremely loose.

The work is almost entirely a machine process. Except in handling the cans of coiled sliver, it is not particularly fatiguing, but, as in opening and picking, there is much dust and fine lint. Where subsequent processes are carried on in the same room with carding, this dust hazard extends beyond the workers engaged in carding alone. Most of the operatives in carding rooms are men.

Combing. This process, which is used only in the manufacture of the finer grades of yarn, does more perfectly what the carding machine has started. The slivers of fiber are more thoroughly cleaned, short fibers removed, the remaining ones laid smoothly in parallel rows, and the sliver again coiled in cans. But little physical effort is required of the operative, who may from time to time remain seated without interruption of the process. Women and girls, as well as men and boys, are employed in this operation.

Drawing. In the process of drawing, the slivers from the carding or combing machines are run through a series of rolls, geared at successively increasing speeds; several slivers are combined and drawn into one, no larger but more uniform in weight than any of the original ones, and again automatically coiled in cans. The work of drawing demands constant attention of the operator and is fatiguing. Women, as well as men and boys, are employed in this work.

Roving. In roving, which is an intermediate process between drawing and spinning, the sliver as received in cans from former processes is run through fly frames, where it is further drawn out and also given a slight twist. For coarse yarn, the sliver is passed through two frames — the slubbing frame and the roving frame — but for finer yarns intermediate frames and sometimes jack-frames are also used. Each of these draws the sliver out finer and

finer and imparts additional twist. When it leaves the fly frames, the cotton, now called roving, is wound on bobbins and is ready for spinning.

Women are employed in this work, which is comparatively light, permitting the operatives to remain seated a part of the time. An exception occurs in the case of slubbing, where, on account of the weight of the bobbins and the fact that they have to be lifted to some height, the work is rather difficult for women. However, the bobbins become smaller and lighter as the process of roving advances from one set of machines to another, and in the final stages of roving they are so light that women can easily handle them.

The roving machines are sometimes called speeder frames and the operatives speeder tenders.

Spinning. Up to this point practically all that has been done is to clean the staple, straighten it, comb it so that the various fibers are parallel, and then draw it out into a coarse strand, with practically no more twist than to give it the strength necessary to prevent breaking. In the process of spinning, this strand is drawn out to the desired size by rollers and twisted while being wound on bobbins or cops which are rotated on spindles frequently eight thousand and sometimes more than ten thousand times per minute.

There are two methods of spinning: mule spinning, the older method, which is very extensively employed in England, and ring spinning, which is employed in a great majority of cotton manufacturing establishments in the United States. In 1914 about 88% of the total spindles in this country were ring spindles; the percentage has increased steadily for many years.

In mule spinning the spindles are mounted on traveling carriages, which alternately back away from, and return to, the drawing rolls. During the process the yarn is drawn, twisted, and wound on cops mounted on the spindles.

In ring spinning the spinning frames are provided with additional drawing rolls, and each spindle is equipped with a stationary ring, around the upper flange of which a wire device, called a traveler, is revolved by the yarn as it is spun or twisted. The traveler does not revolve as rapidly as the spindle and so winds the yarn on the bobbin.

The work of the spinner consists chiefly of joining together the ends of any yarns which may become broken. The work is not heavy, and there is some opportunity for the operatives to sit down, although they are required to stand most of the time because of the large number of spindles attended by one operative and the fact that all of them cannot be seen from a single position.

Women, boys, and girls are generally employed in ring spinning, but mule spinners are almost exclusively men, largely because of the intricate nature of the machinery and the danger of women having their clothing entangled in it. The work of the boys largely consists in doffing, that is, replacing full bobbins with empty ones, but in some mills they also assist in joining broken ends. Since in doffing the entire spinning frame is stopped, doffers are required to work rapidly. They ordinarily have considerable leisure, however, between doffing periods.

Spooling. Warp yarns, that is, the yarns which are to run lengthwise in the finished cloth, are rewound on large spools which hold the product of several bobbins. Girls are employed at this work, which is not laborious, but demands constant attention; a mechanical knot-tying device worn on the right hand is commonly used.

Warping and Beaming. This is a simple process, which consists of unwinding the warp thread from the spools just described and rewinding it evenly on a long spool or beam. In some mills the product of two or more beams is rewound on a single larger beam.

The work of a warper tender consists chiefly of tying up broken threads and necessitates considerable standing while at work, and some bending over the beam. While women and girls are usually employed in this process, the heavy work of changing the beam is done by men.

Slashing. This process consists of unwinding the yarn from the beam, passing it between rollers covered with a solution containing starch, tallow, and other ingredients, in order to give it greater strength, to set the twist, and to coat it so that the chafing in the loom will not weaken it. The yarn is then dried by being run over heated cylinders and rewound on another beam. Usually the product of several beams of yarn, as it comes from the warping process, is handled at one time and rewound on a beam called the loom beam, later placed in the loom, the

different threads being kept from sticking together by passing the yarns between rods.

Because of the constant handling of the beams the work of slashing is heavy. The temperature of the slashing room, moreover, is often high; men are almost exclusively used at this work.

Drawing-in. This process, which is preliminary to that of weaving, consists of passing the warp threads, as wound on the beam just described, through the harness of the loom. The harness, which is detached from the loom during the process of drawing-in and placed in front of the worker about on a level with her eyes, consists of pairs of parallel bars with cords stretched vertically between them; sometimes strips of metal are used instead of cords. In the middle of each cord or strip is an eye through which a warp thread is passed. The warp threads must also be drawn between parallel upright wires closely set into a frame called a reed. The process, which is similar to that of threading a very large needle and passing the yarn between the teeth of a comb, involves very close attention and considerable eye strain. The operatives, usually women and girls, are required to sit continuously at their work. In the case of plain goods the operation is often performed by machine.

Because of the constant attention required, the posture of the worker and the monotony of the work, drawing-in by hand is one of the most fatiguing processes in the manufacture of cotton goods.

Weaving. While modern weaving machinery is to a novice extremely complicated, its fundamental principle is practically the same as that of darning a stocking or weaving a basket. Plain weaving consists of the automatic raising and lowering of the alternate threads of the warp, and the shooting between them, while thus separated, of an automatic shuttle containing filling or crosswise thread, the process being constantly repeated. In the mean time the reed moves forward, beating or pressing each weft thread into place so as to make a close fabric. In the case of more complicated weaving various combinations of warp yarns are raised and lowered, thus weaving a design into the product.[1]

[1]The most complicated designs are woven on Jacquard looms, which control each thread of the warp separately by the use of perforated cards similar in principle to those used in a player-piano.

Both men and women are employed in weaving. The work requires constant attention, and is exacting. Weavers have some opportunity to remain seated during their work; they are not, however, obliged to remain seated, as in the case of the hand drawing-in processes. A weaver tends several looms, in the case of automatic looms, sometimes as many as twenty, and in addition to mending broken threads, in some cases refills the shuttles with bobbins, draws the filling yarn through the eye of the shuttle, and places the shuttles in the looms. Looms which automatically perform the last three operations are rapidly coming into general use. The weaver also sometimes cleans the looms.

Loom fixers, as the name suggests, are mechanics who keep the looms in order and make necessary repairs; they also put the warps on the loom. Men are exclusively employed at this work. While comparatively few in number, their efficiency has much to do with the efficiency of the weaving room as a whole.

Finishing and Converting. The product of the loom is cloth. The various warp threads have been interlaced with the filling so as to make a close fabric. For those mills which sell the goods in this form, known as "grays," the process of cotton manufacture is now complete, except for inspection. For the cloth goods of ordinary use, however, the various processes of bleaching, starching, and in the case of most colored goods dyeing[1] and printing, are yet to be performed. These processes are collectively referred to as converting. Few mills do their own converting. Most of this work is performed by men.

From what has been said, it is clear that heavy labor in a cotton mill is in the main limited to lifting, either of bales of cotton, cans of sliver, or beams of yarn. Most of the other work is light, but in some processes constant attention or great agility is necessary, and this must be considered in estimating the degree of fatigue involved. In the case of drawing-in, there is the added factor of eye strain and the constant sitting required. In numerous occupations, on the other hand, the worker does not have to give constant attention and there is considerable opportunity for relaxation and even for rest.

---

[1]In some cases the yarn is dyed before weaving.

The heavy work is almost invariably done by men. That the work of women in a cotton mill is comparatively light is also indicated by the following excerpt from a special report of the U. S. Bureau of Labor on Woman and Child Wage-Earners, issued in 1910:

> The only occupation in which women are engaged that requires much lifting is that of speeder tending. The bobbins of roving must be lifted to the top of the speeder frames, from five and one half to six feet above the floor. The bobbins which must be placed on the first speeder vary in weight from one to four pounds. They are heavier when coarse yarn is made, hence in the South men are generally employed in this occupation, and in New England, where fine yarns mostly are spun, women are more commonly employed.
>
> The only occupations in which women are engaged that require much bending over are beam warping and to a less extent weaving. There is no other occupation in which women have strained positions in working.

Against this lightness of the work is to be considered the noise, the rather high temperatures of certain rooms, and the monotony.

PRESENT HOURS OF LABOR IN COTTON MILLS

In the following table is given a statement of the number of cotton manufacturing establishments which filed replies to the schedule, together with the number of employees, classified so as to show the number working on each weekly schedule of hours. Because of marked differences in the length of the work-week and in other respects, northern and southern mills are grouped separately.

The table shows that over 76% of employees in northern cotton mills covered by the investigation were working on schedules of 54 up to 55 hours per week, in nearly every case 54 hours. About 18% more were in establishments where the hours were 55 up to 56, usually 55 hours. In other words, 94% of the employees in northern mills covered by replies to the schedule were

TABLE 2: NUMBER AND PERCENT OF ESTABLISHMENTS REPLYING TO THE SCHEDULE AND NUMBER AND PERCENT OF EMPLOYEES, GROUPED ACCORDING TO PREVAILING HOURS PER WEEK, 1917.

(National Industrial Conference Board.)

Hours prevailing per week	Establishments		Employees	
	Number	Percent	Number	Percent
NORTHERN MILLS				
Total	109	100.0	82,036	100.0
Under 52	0	0.0	0	0.0
52 and less than 53	1	0.9	1,340	1.6
53 " " " 54	1	0.9	1,566	1.9
54 " " " 55	79	72.5	62,474	76.2
55 " " " 56	23	21.1	14,777	18.0
56 " " " 57	2	1.8	1,379	1.7
57 " " " 58	0	0.0	0	0.0
58 " " " 59	0	0.0	0	0.0
59 " " " 60	0	0.0	0	0.0
60	3	2.8	500	0.6
SOUTHERN MILLS				
Total	57	100.0	34,347	100.0
56 and less than 57	2	3.5	6,279	18.3
57 " " " 58	2	3.5	941	2.7
58 " " " 59	1	1.8	56	0.2
59 " " " 60	1	1.8	57	0.2
60 " " " 61	51	89.4	27,014	78.6

in establishments where hours were 54 or 55 per week. Only two establishments were operated less than 54 hours per week, and only three operated more than 57 hours.

This practical uniformity of the work-week in northern mills is largely the result of state legislation restricting hours for women. On account of the high proportion of women workers this legislation has the indirect effect of fixing hours for men as well.

The southern mills make a very different showing. Here approximately 79% of the workers were in establishments where the prevailing nominal hours were 60 or more per week; only 18.3% were in establishments where the hours were as few as 56 per week. None was on a shorter schedule than 56 hours. The prevailing work-week in southern cotton mills is 60 hours.

SATURDAY HALF HOLIDAY

The Saturday half holiday is almost universal in the cotton manufacturing industry in the United States. Of

109 northern establishments filing replies to the schedule, no less than 108 closed at noon on Saturday. While the proportion among southern mills was somewhat smaller, 50 out of the 57 establishments filing replies to the schedule observed the Saturday half holiday.

Nominal and Actual Hours

Because of tardiness, sickness, and other causes, there is in any industry, of course, a margin between the nominal or schedule hours and the actual hours spent at work. In many industries this margin, averaged over the entire working force, amounts to several hours per week. Except for this normal loss of time, actual hours of work in northern cotton mills are fairly close to the nominal or schedule hours. It is the general practice for operatives in a northern cotton mill to appear at the factory at the stated hour for opening and to remain there until the stated hour for closing. This applies to pieceworkers as well as to dayworkers. There are some exceptions in particular occupations.

In southern mills the margin of lost time appears to be considerably larger, a fact which may be significant in connection with the longer nominal hours in the South.

Time Actually Spent in Physical Effort

As already pointed out, in many processes cotton mill operatives are not engaged in actual physical effort for the entire time that they are in the mill. One manufacturer stated:

> Employees in textile plants are actually at work only from 60 to 75% of the time they are in the mill.

Another manufacturer gave the following estimates of percentages of time spent in the factory in which operatives were actually working.

Doffing	50%	Spinning	75%
Speeder-tending	60%	Spooling	100%
Warping	60%	Beaming	100%

These figures are not presented as typical, but merely to illustrate the fact that operatives in many departments in a cotton mill have considerable leisure time during factory hours.

In the case of boys engaged in various processes, it was stated in a report of the Public Health Service[1]:

> An effort to estimate the spare time of boys examined indicated that ordinarily the duties of sweepers, back boys, doffers and cleaners, duties which most of the boys under sixteen years old are found performing, involve a total of about five hours of actual labor out of the eight they are permitted by law to work.

[1] M. Victor Safford. Influence of Occupation on Health During Adolescence. Public Health Bulletin, No. 78.

HOURS AND OUTPUT—NORTHERN MILLS

The broad results of the investigation with respect to output under different weekly hours of work, as reported in replies to the schedule, are given in the appendix tables which present in concise form the experience of those cotton manufacturers who had reduced hours and who stated the results; the information applied to the most recent reduction in hours unless otherwise stated. The tables, and particularly the quoted statements of the individual manufacturers, should be examined in detail. A summary table of results is given below; the full significance of the figures, however, cannot be appreciated without reference to the text.

TABLE 3: NUMBER AND PERCENT OF NORTHERN ESTABLISHMENTS REPLYING TO THE SCHEDULE AND NUMBER AND PERCENT OF EMPLOYEES, GROUPED ACCORDING TO THE EFFECT ON OUTPUT ACCOMPANYING REDUCTION IN HOURS.

(National Industrial Conference Board.)

Effect on output accompanying reduction in hours	Establishments		Employees	
	Number	Percent	Number	Percent
Total	95	100.0	73,417	100.0
Maintained	6	6.3	5,640	7.7
Decreased	64	67.4	43,545	59.3
Effect unreported . .	25	26.3	24,232	33.0

This table includes only 95 of the 109 northern mills, the others not having reported a reduction in hours. The mills here included manufactured a wide range of product, including cotton piece goods, lawns, duck, cotton and silk mixtures and sateens. The processes of manufacture, however, are so generally similar that the group can be studied as a whole.[1]

The average hours of the three groups before and after the reductions are shown in the following table:

[1]See footnote 2 on page 1.

TABLE 4: AVERAGE HOURS AFTER AND BEFORE REDUCTION, AND AVERAGE REDUCTION IN HOURS OF NORTHERN ESTABLISHMENTS REPLYING TO THE SCHEDULE, GROUPED ACCORDING TO EFFECT WHICH ACCOMPANIED REDUCTION.

(National Industrial Conference Board.)

Effect on output accompanying reduction in hours	Average hours after reduction	Average hours before reduction	Average reduction in hours
Maintained	54.5	57.3	2.8
Decreased	54.3	57.2	2.9
Unreported	54.1	56.5	2.4

There was, therefore, no significant difference between the reporting groups in average present hours, or the average previous hours. Average hours, however, do not afford a satisfactory basis for comparison. The following table presents the results for each weekly hours-of-work schedule:

TABLE 5: NUMBER OF NORTHERN ESTABLISHMENTS REPLYING TO THE SCHEDULE AND NUMBER OF EMPLOYEES, GROUPED ACCORDING TO PRESENT HOURS AND THE EFFECT ON OUTPUT ACCOMPANYING REDUCTION OF HOURS.

(National Industrial Conference Board.)

Hours prevailing per week	Establishments			Employees		
	Effect on output			Effect on output		
	Maintained	Decreased	Unreported	Maintained	Decreased	Unreported
Total	6	64	25	5,640	43,545	24,232
52	—	—	1	——	——	1,340
53	—	—	1	——	——	1,566
54	3	49	19	2,192	37,096	15,356
55	3	13	4	3,448	5,070	5,970
56	—	2	—	——	1,379	——

Only 6 of the 95 establishments reported that production was maintained when hours of work were reduced, while 64 reported a decrease in output. The employees embraced in the group maintaining output numbered 5,640, while the group reporting a decrease in output included 43,545.

Maintenance of output when hours were reduced was therefore very exceptional. Moreover, as shown below, in some of these cases special considerations qualify the evidence.

ESTABLISHMENTS MAINTAINING PRODUCTION UNDER SHORTER HOURS

Of the northern establishments reporting that production was maintained when hours were reduced, all were operating either 54 or 55 hours a week. The entire group may therefore be discussed as a whole.

The following table (which should be studied in conjunction with that in the appendix) shows the principal product, the number of employees, and the present and previous hours of each mill reporting that output was maintained under reduced hours.

TABLE 6: PRINCIPAL PRODUCTS, NUMBER OF EMPLOYEES, AND HOURS AFTER AND BEFORE REDUCTION, IN SIX NORTHERN ESTABLISHMENTS WHICH REPORTED THAT PRODUCTION WAS MAINTAINED WHEN HOURS WERE REDUCED.

(National Industrial Conference Board.)

Principal product manufactured	Number of employees	Hours after reduction	Hours before reduction
Plush	173	54	55
Turkish towels	87	54	55
Cotton dress goods	1,932	54	56
Satin, marseilles, and dimity quilts	558	55	58
Lace goods, rugs	1,420	55	60
Fine cotton goods	1,470	55*	60

*54 hours in the case of women.

The first establishment in this group was a comparatively small concern and its reduction was only one hour per week. The results of a previous reduction by this company, from 60 to 55 hours per week, are shown by the following statement:

> When our hours of work were changed from 60 hours to 55 hours per week, it was necessary to purchase extra machinery and hire extra help all through the factory. Our looms run so many picks per minute and had we not secured extra help, the output would have been lessened very nearly 10%.

This mill manufactured plush. It was stated, however, that:

> In the manufacture of plush and velvets it is not more feasible to maintain output in reducing hours than it would be in ordinary cotton manufacturing.

The second manufacturer who maintained output when hours were reduced from 55 to 54 said:

> Our employees, on the 54 hour basis, went to work on the minute, and stopped on the minute, and really worked faster all day. We also use the premium bonus system in our plant, and when we shortened the hours, we increased the bonus somewhat. This might have had something to do with it.

It will be noted that this was a small establishment.

The third establishment stated that pieceworkers turned out practically the same amount of work under the 54-hour schedule as under the 56-hour schedule and that this substantially offset a loss in production by time workers. In further investigation, however, it developed that there had been a radical change in the management of this mill by which modern methods were introduced at the time hours were reduced. Because of this fact, it is obvious that the results obtained cannot properly be attributed to the reduction in the length of the workday. The reduction in hours may have been a contributing influence, but in view of the much more important factors involved, it is impossible to say definitely that this was so.

The fourth establishment submitted no additional information.

The fifth establishment in the list, which reported that production was maintained when hours were reduced from 60 to 55 per week, stated in explanation:

> We know the employees appreciated very much the Saturday half holiday, and we think this was the incentive to them to work more steadily so as not to let the change interfere with their accustomed wages.

About 80% of the employees in this mill were pieceworkers. An official of the company stated, however, that no particular change in production of time workers was observed. The company manufactured a rather specialized product.

The sixth establishment stated that it was unable from its records to furnish further information.

Summing up, it will be observed that several of these mills were manufacturing special lines of product, and it seems possible that the opportunity for the workers to influence output may have been somewhat greater in these than in the case of mills making more common lines. In one case, there was a change in management and in two cases the reduction in hours was very slight.

The evidence that production was maintained on a 54-hour schedule is, therefore, not only limited, but inconclusive.

ESTABLISHMENTS REPORTING A DECREASE IN OUTPUT UNDER SHORTER HOURS

Of 70 establishments reporting the effect of reductions in hours upon output, no less than 64 reported a decrease. In most cases the reduction in output was stated to be about proportional to the reduction in hours. The preponderance of evidence is so marked that extended analysis of the data is unnecessary.

The following data, taken from the detailed tables given in the appendix, show the percentage losses in output reported by representative northern mills compared with the percentage reductions in hours of work.

	Percentage decrease in hours	Reported percentage decrease in output per employee
From 56 to 54 hours	3.6	Proportional. 3½%. 3 to 4%. Proportional for time workers—a little less than proportional for pieceworkers. Proportional reduction. About proportional. 3½%. 1½%. Proportional. 4%. Approximately proportional. Proportional.
From 58 to 55 hours	5.2	5%. 5%. 3% for pieceworkers, 5% for time workers.
From 58 to 55 hours	5.2	5%. 2%.
From 60 to 54 hours	10.0	10%. Proportional.

This summary shows striking unanimity of opinion among cotton manufacturers that reduction of two or three hours to 54 or 55 per week in the cotton manufacturing industry has involved an approximately proportional reduction in output. Substantially similar reports were made as to the effects of reductions from 58 to 56 hours per week, but only a comparatively small amount of information was obtained as to the effect of reductions from 58 to 56 hours.

Practically similar statements were obtained from those establishments, covered by field visit, which did not file replies to the schedule.

While the statements alone are fairly convincing, it is desirable to compare them with statistical evidence. Before doing this a few special considerations may be noted.

IMPORTANT FACTORS BEARING ON EFFICIENCY

Machine Time Feature of Work

Undoubtedly one chief explanation of the results just presented is the importance of "machine time," or machine tending in many processes. As an illustration of the extent to which machine time dominates certain processes in cotton manufacturing, as, for instance, spinning, it may be noted that in ring spinning a single operative frequently tends from about 700 to 1,200 spindles, and even then ordinarily has considerable leisure. Except for time lost in doffing, breakdowns, and accidents, the only thing which interferes with the maximum production of a spindle is breakage of the yarn, in which case only individual bobbins are affected. The principal duty of the spinner is the joining of broken threads.

Since the number and incidence of these breakages is beyond the control of the operative, the chief opportunity to increase efficiency is in the more prompt discovery and repair of broken yarns. The number of breakages is usually small, and the machine time feature dominates to such an extent that, provided operatives are ordinarily attentive to their duties, the opportunity to affect the

day's output by greater personal efficiency is very limited. During most of the time all bobbins are winding, and while several under the care of one operative may be out of service simultaneously, the average time lost from breakage of yarn probably represents less than 1% of the total spindle time.

A representative of one mill estimated the total loss of productive time on spinning frames due to breakage of yarn at not over ½ of 1%. Others stated that they had no figures, but that they were satisfied that the amount of lost time due to this cause was almost negligible.

In this connection it is interesting to point out that for a yarn as fine as size 100, on a frame with a front roll 1 inch in diameter revolving 70 times a minute, a spindle making 9,400 revolutions per minute would in a week of 60 hours wind only one quarter of a pound of yarn. The effect of a few minutes more or less of lost time on an occasional spindle can, therefore, hardly be measured.

Weaving presents a somewhat greater opportunity for the operative to increase output by his own effort, although here again the machine controls. In some modern looms the process is almost wholly automatic. The mere fact that a single weaver frequently tends as many as twenty automatic looms gives a fair idea of the limited extent to which weavers can increase the hourly rate of output.

It is necessary to discriminate sharply between different kinds of automatic machinery. For instance, one of the experts of the British Health of Munition Workers Committee said of the highly automatic work of boring top caps in a munitions factory:

> Cursory observation of the youths boring top caps would suggest that by no possibility could they increase their hourly output however short their hours of work, but the data adduced show that this view is erroneous, and that a more persistent and continuous application to their machines could effect an improvement of 29% or more.[1]

---

[1]Health of Munition Workers Committee, Memorandum No. 18.
The increase was ascribed by the British report largely to elimination of Sunday work and other reductions in hours. As pointed out in "Analysis of British Wartime Reports on Hours of Work as Related to Output and Fatigue" (N.I.C.B. Research Report No. 2) only a part of the increase should be attributed to this factor.

The process referred to in this statement, however, involved the hand feeding of an automatic machine, whereas much of the machinery in a cotton mill is automatically fed and is equipped with automatic stop-motions. In automatic looms a battery of bobbins is placed in a circular drum which revolves and drops a full bobbin in the shuttle whenever necessary, the empty one being thrown into a receptacle.

Where machinery must be fed by hand output ceases whenever the operative is away. In the case of most cotton machinery, on the other hand, the operative frequently is away for some little time. If there is no breakage of yarn, or accident, the output is not affected by temporary absence of the worker. Indeed, automatic looms are sometimes run without attendance during the noon hour and for a period after the closing hour. If the yarn breaks or runs out, the loom automatically stops.[1]

The difference between efficiency of workers on such machines and on machines which depend absolutely on continuous attendance of the operative is apparent.

It should not, however, be assumed that cotton mill workers cannot affect output by increased personal effort. The varying number of looms assigned to different weavers indicates a difference in individual efficiency and shows that the machinery does not completely control. The statements presented elsewhere as to the smaller loss in production by pieceworkers than by dayworkers also are suggestive.[2] Moreover, a substantial increase in *hourly* output was at times reported, but in only a few instances was it sufficient to offset the effect of shortened hours for the mill as a whole, and, as already shown, conditions in some of these cases were so exceptional that the results are of very limited significance.

In certain processes where it was possible to offset the effect of reductions in hours, the number of workers engaged was often small, a fact which must be taken into account in considering the best arrangement of hours for the force as a whole. Roughly speaking, in a cotton mill doing both spinning and weaving 20% of the workers are engaged in spinning processes and 30% in weaving. On the other hand, drawing-in, which when done by hand

[1]This practice does not enter into the statistical comparisons given later in this report.

[2]See page 24.

is one of the most fatiguing processes in cotton manufacture, ordinarily does not include over 2% of the total force.

So far as machinery is concerned, maximum speed practically obtainable with present equipment probably has been attained in most northern mills. Manufacturers were almost unanimous in the opinion that attempts to increase the speed of spindles or looms in their establishments would result in such an increase in breakage of yarn as to reduce efficiency rather than to increase it.

The president of a northern spinning mill said in this connection:

> The speed of the machinery depends so much on the stock and quality needed to be produced that it is practically impossible to increase speeds to any extent to offset shorter hours.

Size of Establishment

It is difficult to determine how far the size of the establishment influences the ability of cotton mills to maintain production when hours of work are reduced. In the following table results are compared on the basis of the number of employees per establishment:

TABLE 7: NUMBER AND PER CENT OF NORTHERN ESTABLISHMENTS WHICH REPORTED EFFECT ON OUTPUT ACCOMPANYING REDUCTION IN HOURS, GROUPED ACCORDING TO EFFECT AND TO NUMBER OF EMPLOYEES.

(National Industrial Conference Board.)

Number of Employees	Number		Percentage	
	Production Maintained	Production Decreased	Production Maintained	Production Decreased
Total	6	64	100.0	100.0
Under 100	1	3	16.7	4.7
100 to 1,000	2	49	33.3	76.5
1001 to 2000	3	9	50.0	14.1
2001 and over	0	3	0.0	4.7

Average number of employees in establishments which reduced hours without a decrease in production 940

Average number of employees in establishments in which a reduction in hours was accompanied by a decrease in production 680

This table shows that of the six companies reporting that production was maintained when hours were reduced, three, or 50%, employed over 1,000 operatives each. On the other hand, of those companies reporting a decrease in output, only twelve out of sixty-four, or but 19%, employed 1,000 operatives or more.

On the surface, these figures indicate that the larger establishments were better able to offset the effect of reductions in hours of work than were the smaller ones, although they were seldom able to offset it completely.

One advantage of size, of course, is the opportunity for a better division of labor and the greater efficiency of management possible in large mills with ample capital.

Influence of Piecework System

The average proportion of pieceworkers in northern cotton mills reporting on this point was approximately 55%. The proportion varied from practically nothing to 90% or more, and the average is applicable to only a small number of concerns.

As in the case of several other industries studied thus far in the course of the Board's investigation, there seems to be a rather definite relationship between efficiency and the piecework system. Several of the reports show that reduction in output was less marked for pieceworkers than for dayworkers. In a few cases, pieceworkers practically maintained production when hours were shortened, although the output for the factory as a whole usually decreased. The following statements, taken from replies to the schedule, are representative:[1]

> Piecework was not affected to any extent, as employees were able to produce practically the same amount as formerly.
>
> In the case of pieceworkers, total output per employee was reduced a small percentage less than the reduction in hours; in case of dayworkers the reduction in product was proportional to the reduction in time.

[1]See table, page 59.

Labor cost per unit increased for piecework 2%; for daywork, 3½%.

A slight gain in production per hour by pieceworkers but not commensurate with the reduction of hours.

Where costs were governed by piecework the cost of production did not increase the full 10% due to shorter hours, about 8% covered the average increased costs, showing that pieceworkers improved their effort. With the dayworkers this did not obtain.

Loss in production of about 3% for pieceworkers and 5% for time workers.

In connection with this question of the relative efficiency of piecework and daywork, it may be noted that an official of a textile union said:

> Under present conditions daywork is much fairer to the operatives than piecework. Much time is lost in the average mill through causes for which the operatives cannot be held responsible and it is not fair to keep them at the mills when they are not actually being paid for their time. If a system could be installed whereby a certain rate was paid for idle time which was not due to inattention or other act on the part of the operative, then piecework would unquestionably be the fairer, both to the manufacturer and the operative.

ATTITUDE OF WORKERS

Several manufacturers reported that reduction in hours exerted a favorable effect on the attitude of workers. Others stated that the effect had been adverse. In most cases, no significant effect was reported. Reports on this point, however, were not sufficiently general to warrant conclusions.

ATTITUDE OF NORTHERN MANUFACTURERS TOWARDS A 54-HOUR WEEK

Despite the fact that it was the general experience of cotton manufacturers that reductions in hours of work to 54 per week had involved a reduction in output, many northern manufacturers made no objection to such a work-week.

One manufacturer who reduced from 60 to 54 hours, and who reported a decrease in output, said:

> We find the 54-hour schedule worked out to our satisfaction; employees were also pleased with new schedule.

A representative of a group of important mills likewise stated that although the 54-hour week had reduced output, he did not favor a longer week in northern cotton mills.

On the other hand, several manufacturers saw no advantage in a shorter week. The following statement is fairly representative of several obtained during the course of the investigation:

> We do not think that reducing hours benefits the operatives either physically or morally, or in their efficiency.
>
> The machinery in a cotton mill is run at a certain speed and in a great many cases must either give product or produce waste. With the decrease in hours, we do not see any improvement in the waste made or product per hour, or the quality of the work.

A manufacturer operating on a 54-hour schedule said:

> We do not think that a decrease in the hours of labor increases the efficiency per hour of the operatives. In our judgment, reducing the hours of labor and increasing the earning capacity of the operatives, as a whole means rather decreased general efficiency, as the operatives are not apt to work as steadily.

The head of a spinning company who also found that production was reduced under a 54-hour schedule, expressed himself as satisfied with a 54-hour week and said in this connection:

> We have noticed this difference when hours have been shortened. More kinds of people are willing to work in the mill at 54 hours than at 56, 58, or 60, and in ordinary times we feel that it would be easier to keep a full crew than when working longer hours.

> . . . We feel that the economic side of shorter hours is not understood by most people and that any shortening of hours and lessening of output means that it is going to cost more to live. It is better to work longer and harder and have enough to eat and a comfortable home than to work less and not be properly nourished or housed. The same pay for less hours of work is really a reduction in pay measured by what a dollar will buy. Each time that hours in a mill are reduced the product costs more. We do not believe that it is necessary to reduce the working hours in mills further to safeguard the health of the employee and do believe that any further reduction would injure both the industry and the buying public.

These are, of course, statements of employers, and while the Board accepts them as made in good faith, conclusions on this point cannot in fairness be drawn without considering views of workers as well.

HOURS AND OUTPUT—SOUTHERN MILLS

Although particular effort was made to obtain representative data for southern mills, only 57 southern establishments, employing 34,347 operatives, submitted replies to the schedule of inquiries. The geographical distribution and prevailing hours of these mills has already been presented.[1] A large proportion of southern operatives are now working under a nominal schedule of 60 hours.

Thirty-five of the southern establishments reported a recent reduction in hours, and of these 20 stated the results of such reduction on output. This number is too limited to permit of satisfactory conclusions and the results presented in this chapter for southern mills should, therefore, be regarded merely as a matter of information. Although the data may fairly reflect conditions in the South, it would be quite unscientific to assume this in the absence of a broader basis of experience. It is hoped to obtain more extensive data for southern mills later.

A comparison of results for the 20 mills which reported that hours had been reduced is given in the following table:

TABLE 8: NUMBER AND PERCENT OF SOUTHERN ESTABLISHMENTS REPORTING REDUCTION IN HOURS AND NUMBER AND PERCENT OF EMPLOYEES, GROUPED ACCORDING TO THE EFFECT ON PRODUCTION ACCOMPANYING REDUCTION IN HOURS.

(National Industrial Conference Board.)

Effect of output accompanying production in hours	Establishments		Employees	
	Number	Percent	Number	Percent
Total	35	100.0	22,042	100.0
Maintained	4	11.4	1,797	8.2
Decreased	16	45.7	13,162	59.7
Effect unreported . .	15	42.9	7,083	32.1

This table shows, therefore, that only 4 southern establishments reported that production was maintained

[1]See pages 2 and 12.

when hours were decreased. Three of these reduced from a 66 to a 60-hour schedule.

The average hours of these three groups before and after the reductions are shown in Table 9.

TABLE 9: AVERAGE HOURS AFTER AND BEFORE REDUCTION, AND AVERAGE REDUCTION IN HOURS OF SOUTHERN ESTABLISHMENTS REPORTING REDUCTIONS IN HOURS, GROUPED ACCORDING TO EFFECT ON OUTPUT WHICH ACCOMPANIED REDUCTION.

(National Industrial Conference Board.)

Effect on output accompanying reduction in hours	Average hours after reduction	Average hours before reduction	Average reduction in hours
Maintained	60.0	65.5	5.5
Decreased	59.4	63.8	4.4
Unreported	59.7	64.7	5.0

In the case of the 16 companies which reported a decrease in output, the reduction was from an average of about 63.8 hours per week to about 59.4 hours. As already noted, these averages are not satisfactory as a basis for analysis. Reference should, therefore, be made to the detailed table in the appendix which gives the important facts furnished by each of the southern establishments.

A southern company which reduced from 60 to 57 hours said:

> We have reached the limit where hours can be reduced, without reducing production. Fifty-seven hours per week is satisfactory to employer and employee in this section at present time. To make a safe and economic condition in textile plants, taking into consideration the rights of the employer, employee, and the public, the minimum hours of labor should not be reduced much below the present standard, and should be arranged so as to give a half holiday on Saturday.

A southern manufacturer who reduced from 60 to 56 hours by stopping at one o'clock on Saturday said:

> The operatives appreciated the change and we think that many of them are now more punctual and regular in attendance at their work than before.

> There has been no change thus far in rate of production and the stoppage of four hours means that much production lost.

Another southern manufacturer said:

> Cotton manufacturing does not afford a very promising field for reduction of hours *without increase in costs*. Cotton manufacturing is a highly capitalistic industry; in the case of machine labor, the law of diminishing returns does not hold. Any reduction in the hours of cotton mill operatives must come through legislation of universal application. Reduction of hours under these circumstances would be welcomed by manufacturers with a social interest. Such legislation, however, calls up the most complex problems in the economic realm, international as well as national in their scope.

Although a majority of southern establishments reported a decrease in output when hours were reduced to about 60 per week, apparently a 60-hour week is regarded as satisfactory by many southern cotton manufacturers.

For instance, one manufacturer who estimated that output had decreased 8 to 9% after a reduction in hours from 66 to 60, nevertheless said:

> If the schedule can be so arranged as to give Saturday afternoon for half holiday, 60-hour running time as worked in southern mills seems entirely satisfactory to employees and employed.

Another manufacturer who also reduced from 66 to 60 hours, and who reported some loss in production, said:

> In view of the fact that a plant such as ours works a number of hands who have not yet fully developed physically, we are of the opinion that the change from 66 to 60 hours per week was a good one, but wish to state that when we reduced the hours 9% we reduced our production in like proportion.

Another manufacturer also reducing from 66 to 60 hours said:

> Cost naturally went up, but production did not drop 9%. The general attitude and results were satisfactory to us.

STATISTICAL DATA AS TO OUTPUT

DIFFICULTIES OF SECURING COMPARABLE DATA

The unit of measure in most cotton manufacturing establishments up to the process of weaving is the pound. It might, therefore, seem an easy matter to compare the product of a cotton mill under different hours-of-work schedules. As a matter of fact, great difficulty was encountered in efforts to secure data which were strictly or even reasonably comparable. One reason for this is the great range in sizes (counts) and strength (twists) of yarn and in the great variety of weaves in cloth. For instance, a pound of cotton yarn of size 24 represents approximately 20,160 yards, whereas a pound of size 80 represents 67,200 yards. Obviously a spindle revolving at a given rate of speed, say 7,000 revolutions per minute, will wind a pound of the coarser yarn in a much shorter time than it will wind a pound of the finer. Unless the product of a mill is nearly uniform, this factor alone introduces serious difficulties into statistical comparisons on the pound basis. The difficulty is increased because in most mills various sizes of yarn are in process of manufacture at one time and changes from one size to another are very frequent.

The product of the weaving mill is often measured in yards, but in close comparisons it is necessary to take account of the number of picks (cross or weft threads) per inch and per minute. Output for a cloth running 72 picks per inch is not strictly comparable with that for a cloth running 144 picks, as a measure of the effect of changes in hours. Still greater difficulty would be encountered in making a comparison of plain and fancy weaves.

Again, in many weaving mills a number of looms often are idle; not only because of lack of orders, but also because of changes from one weave to another. For comparative purposes, periods of full loomage should

where possible be used, since this reduces the element of uncertainty due to changes in the proportions of looms of different types or pickages. Moreover, it was the general opinion of manufacturers that operatives work more nearly to their abilities when the mill equipment is operated to full capacity.[1] A representative of a textile union expressed a similar opinion.

Atmospheric and climatic conditions also present a complicating factor. Cotton fiber absorbs and throws off moisture very readily within a considerable range. For instance, one manufacturer stated that in ordinary weather 5.35 yards of a certain cloth would weigh a pound, whereas in damp weather 5.20 yards would weigh as much. Still wider variations are by no means uncommon. It is difficult for a mill to maintain uniform temperature and humidity under atmospheric and seasonal changes. Extremely accurate comparisons of output by weight would, therefore, necessitate correction for such differences in moisture content.

In practically no case is it safe to compare the output of one mill with that of another as a measure of the effect of different hours-of-work schedules. Differences in the methods of operation and in efficiency of management may exert a much more important influence than differences in the number of hours of work.

If special or "control" experiments were made for the particular purpose of measuring the effect of changes in hours on output, such factors could be observed and either allowed for or the uncertain data excluded from consideration. On the other hand, such "control" experiments involve other difficulties perhaps quite as serious; for example, the mental effect on the operative which, on the one hand, might stimulate him to unusual effort, on the other hand might so disturb him as to reduce his efficiency.

Most of the latest changes in hours-of-work schedules in northern cotton mills occurred about January 1, 1912. It is quite out of the question to compare figures of output in 1917 under a 54-hour schedule with those in 1911 under a 56-hour schedule as a measure of the effect of the reduction in hours on output, since during this interval changes in character of product, in machinery, in methods of

[1]See page 40.

operation, and in the character of the working force often have been so great as to make such comparisons meaningless. Where comparison of output for a period shortly before a reduction in hours is made with that for a period shortly after such reduction, however, these factors can ordinarily be disregarded.

OUTPUT COMPARISONS

For these and numerous other reasons precise data which would permit of accurate mathematical deductions as to the effect of different hours-of-work schedules on production can be secured, if at all, only after most painstaking efforts involving much time. Elaborate data of this sort, however, are not absolutely essential. Several mills furnished comparisons of output for periods immediately before and after reductions in hours of work, when the character of product and general operating conditions were substantially similar. The uniformity with which the figures thus obtained indicated a loss in output when hours were reduced to 54 per week, taken in connection with the marked unanimity of opinions submitted by manufacturers, as already shown, made nice allowances for minor factors unnecessary.

Comparison of Output at a Northern Spinning Mill

One comparison of output was furnished by a spinning mill employing approximately five hundred operatives, with complete production records kept over a period when hours were reduced (in 1916) from 58 to 54 per week. This mill was located in a small community and was a modern establishment both in equipment and management. The important results are given in the following table, showing the average output per spindle per week for each size of yarn manufactured during a six-months period under each schedule, and the percentage loss for the second period.[1] The president of the company stated that there were no changes in management, labor, or machinery during or between the periods compared which would invalidate the comparison. The same calendar months were taken in each case so as to reduce differences due to climatic factors as much as possible.

[1] Figures for a few sizes manufactured during only one of the periods are omitted.

TABLE 10: COMPARISON OF THE AVERAGE OUTPUT PER SPINDLE PER WEEK, FOR A NORTHERN SPINNING MILL, FOR A SIX-MONTHS PERIOD ENDING APRIL 29, 1916, UNDER A 58-HOUR WEEK, WITH THAT FOR A SIMILAR PERIOD ENDING APRIL 28, 1917, UNDER A 54-HOUR WEEK.

Size of Yarns[1]	Average pounds per spindle per week		Percentage loss
	First Period 58 Hours	Second Period 54 Hours	
3	13.80	11.84	14.2
7	6.54	5.84	10.7
8	5.68	5.18	8.8
12	4.04	3.69	8.7
15	3.00	2.71	9.7
19	2.44	2.15	11.9
20	1.97	1.74	11.7
22¾	1.94	1.65	14.9
24	1.57	1.34	14.6
26	1.32	1.28	3.0
30	1.21	1.12	7.4
33	1.02	.97	4.9
40	.80	.76	5.0
45	.68	.60	11.8
60	.50	.47	6.0
80	.34	.33	2.9

This table shows a decrease in the production per spindle under the 54-hour week as compared with the 58-hour week for every size of yarn manufactured. There was considerable variation in the percentage of decrease, however, several sizes showing reductions roughly of 10 to 14%, while in two cases the loss was as low as 3%. In general, the smaller decreases occurred in the higher counts, i.e., the smaller sizes.

The reduction in hours was 6.9%.

This comparison indicates clearly and conclusively that in this instance the reduction in the number of hours was accompanied by a decrease in total output per spindle. The percentages of loss shown, however, should not be taken as a precise or even a very close measure of the decrease due solely to the shortening of the day. It often happens that there are considerable variations in the same mill with the same schedule of hours. For instance, a comparison for this company for two periods under the 58-hour schedule indicated a variation in average weekly output per spindle ranging from zero to as high as 8%; the latter occurred in the coarser yarn and was exceptional.

[1]See footnote page 33.

While, however, the decreases shown in the above table may not have been due solely to the single factor of a shorter work-week, the amount of the decreases and the fact that they occurred for every size of yarn leaves no room to doubt that the reduction in hours from 58 to 54 was largely responsible.

Comparison of Output of a Weaving Room of a Northern Mill

A comparison of the product of a weaving room in a northern mill which had produced a substantially standard line of goods for a long time is given below. This was a modern establishment well equipped, with efficient management and a relatively good class of operatives.

TABLE II: COMPARISON OF THE OUTPUT OF A WEAVING ROOM IN A NORTHERN MILL FOR MAY, OCTOBER, AND AUGUST, 1911, UNDER WEEKLY SCHEDULES OF 56, 54, AND 51¼ HOURS, RESPECTIVELY.

	May, 1911. 56 hours 2,750 looms	October, 1911. 54 hours 2,753 looms	August, 1911. 51¼ hours 2,750 looms
1st week	206,500 lbs.	202,800 lbs.	182,000 lbs.
2d "	203,000 "	200,000 "	187,500 "
3d "	204,000 "	200,000 "	185,600 "
4th "	210,000 "	201,000 "	187,900 "
Total	823,500 lbs.	803,800 lbs.	743,000 lbs.

This comparison shows that the output in October, 1911, under a 54-hour schedule was about 2⅓% less than that in May under a 56-hour schedule. The reduction in the number of hours worked was 3½%. The number of looms and the number of employees were practically the same in each case.

In August, 1911, when a 51¼-hour schedule was temporarily in force, there was a further pronounced decrease in production, which fell to about 90% of that obtained in May under a 56-hour week; or nearly in proportion to the reduction in hours worked. The experience with a 51¼-hour week was brief and perhaps not sufficiently representative to warrant conclusions, but it indicates clearly that such a reduction in hours involved a serious loss in output. Climatic influences may have contributed to the loss.

Comparison of Output at a Northern Piece Goods Mill

A comparative statement of the output of a northern mill making cotton piece goods under a 54-hour schedule with that under a 60-hour schedule follows:

TABLE 12: COMPARISON OF OUTPUT OF A NORTHERN COTTON MILL MAKING PIECE GOODS UNDER A 60-HOUR SCHEDULE WITH THAT UNDER A 54-HOUR SCHEDULE, 1912.

	First period From June 1, 1912, to August 3, 1912 60-hour schedule	Second period From August 24, 1912 to October 26, 1912 54-hour schedule
Average number of employees	347	347
Units of product (pounds)	267,225	227,727
Average number of looms in operation	863	804
Units per loom	309.6	283.2
Actual hours of operation[1]	577.5	505.4
Units per loom per hour	0.536	0.560
Units per loom per week	32.16	30.24

	Percent
Reduction in hours	10.00
Increase in average hourly output	4.48
Decrease in average output per loom per week	5.97

This indicated an average output of 30.24 pounds per loom per week under the 54-hour schedule as against 32.16 pounds under the 60-hour schedule, or a decrease of 5.97%. The hourly rate of output increased 4.48% under the shorter schedule, but this, of course, was not enough to offset fully the reduction of 10% in the number of hours worked. The figures of output per employee indicate a substantial decrease, but a satisfactory comparison on this score cannot be made, since in the second period the full number of looms was not in operation.

A representative of this company stated that by changing to automatic looms, installing additional machinery and putting more employees in the carding and spinning departments, the output per loom has since

[1]Excluding time lost because of holidays, temporary breakage of machinery, etc.

been brought up to the average secured under the 60-hour schedule, but that this involved an increase in cost.[1]

Comparison of Output at a Mill where the Character of the Product was Less Uniform

The preceding comparisons relate to establishments where operating conditions, and especially the character of product, were substantially similar under different hours-of-work schedules. The influence of other factors which might affect the efficiency of production was thus minimized. Comparatively few mills, however, thus run on standard lines of product for considerable periods of time. Where the character of the product varies materially, an accurate measure of the effect of changes in hours alone is, for the reasons pointed out at the beginning of this chapter, exceedingly difficult. Nevertheless a comparison will be presented for one large mill where there was more or less change in character of product; operating conditions in this establishment are in this respect fairly representative of those in a large number of cotton mills. It must, however, be kept clearly in mind that the comparison is less scientific than those previously presented where the product was more uniform.

For mills of this general type one of the most reliable tests of relative efficiencies is that based on the number of picks, that is, the number of cross or filling threads woven.

Comparison may also be made of the actual efficiency obtained under different hours-of-work schedules as compared with theoretical maximum efficiency of 100%, that is, a comparison of the actual number of picks woven with the total number of picks which could have been woven had the looms been operated for the full number of nominal hours without stoppage from any cause whatever. It should be clearly understood, however, that 100% efficiency in the case of a 56-hour schedule represents a larger number of picks than 100% efficiency under a 54-hour schedule.

A comparison of the output of this mill based on these methods is given in the following table:

[1]See page 43.

TABLE 13: COMPARISON OF OUTPUT OF A NORTHERN COTTON MILL MAKING PIECE GOODS, UNDER WORK SCHEDULES OF 58, 56, AND 54 HOURS PER WEEK.

Reduction from 58 to 56 Hours per Week

PERIOD	58 Hours	56 Hours	Percent Decrease
	4 weeks October, 1909	2 weeks November, 1909 2 weeks December, 1909	
LOOMS RUNNING 160 PICKS PER MINUTE			
Average number looms operating	2,619.6	2,585.2	....
Average number picks per loom	1,729,388	1,671,892	3.3
Percent of maximum possible pickage efficiency attained	77.6	77.6	....
LOOMS RUNNING 175 PICKS PER MINUTE			
Average number looms operating	846.7	1,067.1	....
Average number picks per loom	2,133,153	1,915,858	10.2
Percent of maximum possible pickage efficiency attained	87.6	81.5	....

Reduction from 56 to 54 Hours per Week

PERIOD	56 Hours	54 Hours	Percent Decrease
	4 weeks to Nov. 18, 1911	2 weeks December, 1911 2 weeks January, 1912	
LOOMS RUNNING 160 PICKS PER MINUTE			
Average number looms operating	2,040.4	1,784.1	....
Average number picks per loom	1,545,353	1,417,848	8.3
Percent of maximum possible pickage efficiency attained	72.5	68.4	....
LOOMS RUNNING 175 PICKS PER MINUTE			
Average number looms operating	1,378.5	1,478.5	....
Average number picks per loom	1,807,119	1,737,349	3.9
Percent of maximum possible pickage efficiency attained	76.8	76.6	....

This table shows that in every case the number of picks per loom in operation decreased when hours of work were reduced. It further shows that the percentage of maximum possible efficiency attained was not increased; in

two cases it decreased sharply and in the other two it was practically unchanged. Since maximum product obtainable under a 56-hour schedule is less than that obtainable under a 58-hour schedule, a constant percentage of operating efficiency means a loss in production proportional to the reduction in hours. The fact that the percentage of operating efficiency at times decreased indicates that other factors than the change in hours were also in operation.

It will be noted, moreover, that the number of picks per loom in 1911 under a 54-hour schedule was less than in 1909 under a similar schedule, and this notwithstanding the fact that a considerable number of new and improved looms had been installed during this interval. In this case, obviously, some other factor than that of the number of hours of work was responsible.

While a comparison of output at this mill based on the number of yards is less conclusive than that based on pickages or efficiency percentages, it is nevertheless of interest to note that when hours were reduced the number of yards woven per loom also showed a decrease in every case except one.

This is indicated by the following summary:

	58 Hours October, 1909	56 Hours Nov.–Dec. 1909	Percent Decrease
	Yards per loom	Yards per loom	
160 pick looms	503	476	5.4
175 pick looms	1,051	1,000	4.9
	56 Hours Oct.–Nov. 1911	**54 Hours December, 1911 January, 1912**	**Percent Decrease**
	Yards per loom	Yards per loom	
160 pick looms	496	459	7.5
175 pick looms	995	1,025	*3.0*[1]

By comparison with Table 13 it will be seen that in the single case when the yardage per loom increased there was a substantial decrease in the number of picks woven, which indicates that there was an important change in character of product or in some other respect.

[1] Increase.

Attention should also be called to the great difference in the average yards of cloth woven on the two different types of looms. This well emphasizes the importance of comparing average pickages where different grades of product are made in the same mill. It also illustrates the importance of limiting comparisons, for mills of this class, to the same type of loom or to periods of full loomage in comparisons of total product.

From the detailed figures obtained from this mill it appeared that in certain weeks the number of yards woven under a 56-hour schedule when the full number of looms was in operation was as large as in certain weeks under a 58-hour schedule with a smaller loomage; the same was also true at times of a 54-hour schedule as compared with a 56-hour schedule. When, however, periods where substantially the same number of looms were in operation were compared, a decrease per loom under the shorter schedule was shown in nearly every case. This seems to confirm the contention that the amount of loomage in operation has a definite bearing upon efficiency. However, changes in the character of product may in this case have had a more important bearing.

It is clear, therefore, that comparison of yards of cloth woven, or of pounds, in a mill where the character of product varies considerably would, by itself, be inconclusive. The decrease in total pickages, however, indicates definitely that in this case the reduction in hours both from 58 to 56 per week, and from 56 to 54, resulted in a relative loss in output, although it may not have been wholly responsible for this loss.

Other Comparisons

Another company, making ginghams, submitted the following comparison for periods where conditions of operation were as nearly similar as could be found for any considerable number of weeks:

April 1 to July 1, 1911, 56 hours, 3,824 looms . .	507,023 yards
April 1 to July 1, 1912, 54 hours, 3,757 looms . .	478,885 yards

This shows a reduction of 1.8% in the number of looms and of approximately 5½% in output. The output per loom fell 3.8%. The reduction in hours was 3.6%. It will be noted that the periods covered the same calendar months in each year.

The percentage of pieceworkers in this mill was high — about 80% for beaming and weaving and nearly 65% for carding and spinning. The equipment was modern.

The agent of another mill submitted the following comparison of production for the last quarter of 1909, when the weekly schedule was 58 hours, with that for the first quarter of 1910, when a 56-hour week was in force.

Last quarter of 1909, 58-hour schedule (two holidays)	1,236,972 lbs.
First quarter of 1910, 56-hour schedule (one holiday)	1,158,305 lbs.
Decrease	78,667 lbs.

Here is a loss of approximately 6.3% in output against a reduction of less than 3½% in hours. Making correction for the extra holiday in the last quarter of 1909, the shrinkage in output would be about 5%.

The output of a southern Massachusetts mill making plain goods for the last two months of 1911 under a 56-hour schedule compared with that for the first two months of 1912 under 54-hour schedule as follows:

Last two months of 1911, 56-hour schedule (two holidays)	346,955 lbs.
First two months of 1912, 54-hour schedule (one holiday)	317,296 lbs.
Decrease	29,659 lbs.

In this case there was a loss in production under the 54-hour schedule (after allowing for the extra holiday) of 10%, as compared with that under the 56-hour schedule; the reduction in hours was about 3.6%.

Comparisons of different quarters of the year are somewhat less satisfactory than a comparison for the same quarter in two different years, since seasonal or other conditions may differ sufficiently at different periods of the year to materially affect results.

Comparison of Output of Three Workers under Varying Schedules

The preceding comparisons cover either the entire product of the respective establishments or that of entire departments. Figures were furnished by one mill which, although covering only three workers, are of interest because the conditions were unusually uniform. These workers were engaged on the first intermediate roving frames and were paid on a piece-rate basis. The sizes of yarn were practically the same in each period covered by

the comparison. The data cover a period immediately after the reduction in hours and also periods some months later. Results are given below.

		Hanks per hour
5 weeks ended Oct. 30, 1909.	58-hour schedule	1.920
3 weeks ended Dec. 18, 1909.	55½-hour schedule	1.830
4 weeks ended Jan. 29, 1910.	56-hour schedule	1.915
4 weeks ended Mar. 26, 1910.	56-hour schedule	1.85
5 weeks ended April 30, 1910.	56-hour schedule	1.95
4 weeks ended Jan. 27, 1912.	54-hour schedule	1.915
4 weeks ended Mar. 30, 1912.	54-hour schedule	1.90
4 weeks ended May 25, 1912.	54-hour schedule	1.92

This comparison shows no pronounced and definite change in hourly output under the different hours-of-work schedules. Total output, therefore, in most cases fell practically in proportion to the hours worked. The increase in the hourly rate in April, 1910, was not sufficient to offset the reduction in the number of hours.

A change in the hours of the same workers from 60 to 54 when on a night shift, however, brought a rather marked response in the hourly output, although not enough to offset the loss in time. The comparative output under the two schedules was as follows:

		Hanks per hour
Four weeks in March and May, 1917.	60-hour night schedule	1.915
Four weeks in May and June, 1917.	54-hour night schedule	2.045

Figures for so small a group cannot be given much weight, but they are of interest as suggesting that a more intensive study of output for selected groups of workers under varying lengths of workday would be profitable.

Because it is impossible to isolate completely the effects of changes in hours, no one of these comparisons would by itself warrant general conclusions. The agreement in results for so many establishments, however, leaves no doubt that the reduction in output shown was due, at least in part, to the shortening of hours. Figures showing substantially similar results were secured from various other mills in the course of the investigation, but since in these cases other factors clearly entered into the comparisons, the results are not presented.

In no instance were book figures obtained which showed an increased or even a maintained output for the entire factory force under a 54-hour schedule where all conditions were the same, although this point was taken up

with all of the mills which reported that their output was maintained under such shorter schedule.

Improvements in Equipment Following Reductions in Hours

The fact that, in general, reductions in hours in northern cotton mills to 54 or 55 per week resulted in an immediate reduction of output does not mean that production per employee is less today than under the longer schedules previously in force. One effect of shortened hours is to stimulate improvement in methods of management, in machinery and other respects; such improvements, moreover, are constantly being made independently of changes in hours. In many mills, total production per employee today for the same class of product probably is greater than under any previous hours-of-work schedule. In most cases, however, this has been accomplished only by a heavy increase in investment.

For instance, in the case of the company referred to on page 35, where a reduction to a 54-hour schedule in 1911 resulted in a loss of about 2⅓% in product in October as compared with that in May, the production in 1917, with about 1,100 operatives, was as large as that in 1911 with 1,500. One reason for this is that new and improved looms were introduced. Today an operative tends about ten automatic looms and with a rated efficiency of 95% of possible product, whereas in 1911 the average number of looms per weaver was about four and the percentage of efficiency at times as low as 80. New routing systems have been introduced, and the "layout," as the agent expressed it, improved in general.

Another company, for which figures of output were given on page 36, stated:

> At this particular plant we changed the looms from plain to automatic, and put in additional carding and spinning machinery, with the result that we are today getting about the same pounds per loom from a 54-hour week that we did from a 60-hour week, but of course not at the same cost per pound, due to the increased number of employees required in the carding and spinning departments..

CONCLUSIONS AS TO OUTPUT DATA

It is certain, therefore, that reductions in hours of work in the cotton manufacturing industry to 54 per week have

usually resulted in a loss in total output per employee and in a relative increase in cost of production. In a majority of cases the decrease in output was at least proportional to the reduction in hours.

The results here given, however, should be read broadly and not as an exact quantitative statement of the effect of reductions in hours of work on output. If a precise measure of the effect were desired, much more extensive data and a much more detailed analysis of collateral factors would be necessary. An exact evaluation of numerous factors involves so many difficulties, however, that it is exceedingly doubtful whether the results would be of much greater value than those here presented.

It was the opinion of some manufacturers that a 58-hour week in northern mills was about as productive as a longer week. Some evidence indicating that this view is correct was secured during the investigation, but not enough to warrant conclusions.

It is, however, important to observe that the desirability of any further reduction in hours of work in northern cotton mills depends somewhat, although by no means entirely, on the point at which maximum product per employee is attained. For instance, a reduction of say 3 or 3½% in output in going from a 56-hour to a 54-hour week is perhaps not vital in itself. As already shown, many cotton manufacturers raised no objection to a 54-hour week. But if such a reduction in output has followed a similar reduction in the change from 58 to 56 hours, and possibly also from a still longer week, it is apparent that there has been in process an accumulation of reductions in output. This point should receive attention in considering further reductions in work-hours. In any case, the evident reduction in output as a result of the reduction from a 56-hour to a 54-hour schedule makes it clear that, under present conditions, any further shortening of work-hours in northern cotton mills must involve a substantial addition to cost of production which, in most cases, presumably would be passed on to the consumer.

The problem resolves itself into determining whether such further reduction in hours is desirable regardless of increase in cost. Obviously, a prime consideration in reaching conclusions on this point is the effect of a 54-hour schedule on the health of workers.

HOURS AND HEALTH OF WORKERS

DIFFICULTIES OF THE PROBLEM

Because of the larger number of contributory influences and a lack of statistical information, the difficulties involved in a study of relative health conditions under different hours-of-work schedules are even greater than those encountered in attempts to measure the effect of changes in hours of work upon production.

An enumeration of the causes of sickness among industrial workers is unnecessary in a report of this character. It is worth pointing out, however, that the causes which may be directly attributable to conditions in industry are numerous.[1] In addition to industrial factors bearing upon the health of workers, there must be considered the equally important group of social and personal factors distinct from industry itself, such as housing conditions, personal hygiene, scale of living, and character of recreation. All of these are elements of vital importance in any study of health, yet the great difficulty of measuring and properly evaluating them is obvious.

General Lack of Necessary Data

Practically no evidence was obtained in the course of the investigation which would justify conclusions as to the effect of changes in hours of work upon the health of cotton mill workers. As between so long a week as 66 hours and a week of 60 hours or less, there were indications that health conditions were distinctly better under

[1]The following list taken from the Interim Report of the British Health of Munition Workers Committee indicates characteristics of industry which may contribute to impaired health of the workers:

(1) Excessively long hours of work, particularly by night.
(2) Cramped and constrained attitudes or postures during work.
(3) Prolonged or excessive muscular strain, e.g., the lifting of heavy weights, prolonged standing.
(4) Unventilated or insufficiently ventilated workshops.
(5) Extremes of temperature or humidity.
(6) Imperfect lighting.
(7) Gases, vapours, poisons, and irritating substances.
(8) Dust.

the shorter schedule. Some opinions were expressed, both by manufacturers and by representatives of labor, that the health of workers was better under a 54-hour schedule than under a 60-hour schedule. No statistical or other tangible evidence was, however, obtained. As to relative health conditions under a 58-hour, a 56-hour, and a 54-hour week, practically no information whatever was secured.

Apparently no comprehensive records of sickness among cotton mill workers in this country are to be had. Few companies keep absence records of any kind, and of those which do, only a very limited number record the causes of absence, except that in some cases absences due to accidents are separately noted. Out of 109 schedules received from northern mills in the course of the investigation, only 13 indicated that sickness records of any sort were kept; and of these not one had records in a form, or for a period, significant for the purposes of the study.

Broadly speaking, therefore, it may be said that the inquiry by schedule and correspondence indicated that practically no recorded data were in existence, either among cotton mills or elsewhere, which would supply information as to relative health conditions among operatives under different hours-of-work schedules. Even if extensive statistical data were available, the task of determining just how far any single factor was contributory to the conditions revealed would, in view of the many causes of ill health, be extremely difficult.

GENERAL HEALTH OF COTTON MILL WORKERS

Aside from the question of the health of cotton mill operatives under different hours-of-work schedules, it is desirable to determine, if possible, whether general health conditions in this industry are favorable or unfavorable as compared with other industries, and if unfavorable, whether or not this is due to conditions inherent in the industry itself. Data bearing upon this point, while somewhat extensive, are for the most part not up to date, nor entirely satisfactory for other reasons.

Reports of Massachusetts State Board of Health

In 1905 and 1906 the Massachusetts State Board of Health conducted an investigation of conditions affecting

the health and safety of industrial workers of the state. In its investigation of the textile industry, 93 establishments, comprising several hundred mills, were visited; nearly all of these were cotton mills. In a report on this survey, published in March, 1907, it was stated:

> Of these 93 manufacturing establishments, 19 carry on their manufacture under nearly ideal conditions, and 23 under conditions which may be designated as good. The condition in all of these, including, as they do, nearly half of the number of establishments and much more than half of the number of operatives employed, and the condition of the health of those employed, as determined by their appearance, the testimony of the physicians prescribing for them and the vital statistics of the cities and towns where located, raise the hygienic condition of those employed far above "the most unhealthy classes of wage-earners," with which hygienists have been wont to associate textile workers, even to a very favorable position among wage-earners who are congregated in large numbers within doors.
>
> It would be a source of great gratification if the condition of the minority be raised to so satisfactory a standard. Of these, moderately bad conditions were observed in 35 and distinctly bad in 16 establishments. In all of the two latter classes it seems possible to secure marked improvement in conditions, with not unreasonable expenditure.

In discussing health hazards in the respective processes, special attention was called to the factor of dust in the carding room, as follows:

> Since the amount of cotton dust thrown out into the room by carding machines is greater in proportion to the amount of low-grade cotton used and the large output per card, it follows that all of the operatives in such rooms are exposed to considerable cotton dust, although the men attending to the cards are subjected to the greatest quantity. In some of the coarse-goods mills the carding room contains carding machines only. These rooms are exceedingly dusty.
>
> Considering these conditions from a hygienic point of view, it may be said that a carding room with either excessive heat or excessive moisture is seldom found. The practical questions to be met in the carding room are two, viz.: (1) how to diminish substantially the amount of dust in the room; and (2) how to ventilate the room properly, — both

to be accomplished in old mills, with "reasonable" expenditure. Emphasis is laid upon "old" mills, for the reason that in these the rooms are commonly low studded, with small windows, and devoid of modern means of ventilation and heating. The modern card room is very large and high studded (*e.g.*, 15 feet), with good-sized window glass, and transoms which are easily opened; it is well lighted with arc or incandescent lights, and is heated and ventilated by modern means. In some of the rooms are two or more large exhaust fans. The ceiling and walls are clean and white, and the floor is kept reasonably clean during working hours.

Of the work of ring spinning, the report stated:

Except for the continuous noise of the machinery, which is very great, but in an uninterrupted, unvarying tone, and for the loose cotton dust in the air of the room, the spinners in a modern, well-regulated, ring-spinning room work under favorable conditions.

Of the work of weaving, it was stated:

Weaving necessitates constant attention, although the weaver finds time to sit at intervals.

The finer and more ornamented the fabric is woven, generally speaking, the more care and skill are demanded in the weaver. Some kinds of work require great strength and endurance; some kinds are repugnant, because of the conditions under which the work must be done, as in weaving dark-colored fabrics, or when dust arises from dyestuff or from shoddy; some kinds demand an unusual degree of perfection in the product, calling for constant and minute attention.

Thus it is clear that not only good light, evenly distributed, is a reasonable requirement in the weave room, but that good ventilation and proper regulation of heat and moisture are also hygienic essentials.

Finally, should be mentioned the monotony of tending the machine day in and day out, the roar and buzz and the sharp, jerky noise of the machinery, which is deafening, and, to those particularly sensitive, "nerve-racking."

A bad, unhygienic habit, common to all weavers who tend old-fashioned looms, is that of drawing the filling through the shuttle eye with the mouth. The weaver puts his mouth close to the shuttle, and, by means of a quick intake of breath, sucks the end of

> the thread through the shuttle eye, thus drawing into his mouth more or less fine lint and dust, which gives rise to spitting, and sooner or later may cause irritation of the mucous membrane of the throat. This practice is especially bad because of the fact that, if out for a day a spare hand substitutes. The so-called Northrup loom is gradually replacing the others. In this loom, after the drum is filled with shuttles,[1] the action is entirely automatic.

It will be noted that this report was issued more than ten years ago. Since then numerous improvements in factory conditions have been made. In 1911 a state law was passed forbidding the use of suction shuttles, but some workers still continue to draw the thread in this manner on hand-threading shuttles.

Metropolitan Life Insurance Company's Sickness Survey in North Carolina

In the course of a sickness survey made in 1916 by the Metropolitan Life Insurance Company of New York, in North Carolina, an attempt was made to determine the relative health conditions of white textile workers as contrasted with other white persons (wage-earners and their families) in the same locality. The study covered 43,468 white persons.

The results of this comparison are summarized in Table 14 below:

TABLE 14: RATE OF SICKNESS PER THOUSAND EXPOSED OF ALL WHITE PERSONS; WHITE PERSONS EXCLUSIVE OF TEXTILE WORKERS; AND TEXTILE WORKERS ONLY, IN A SURVEY MADE BY THE METROPOLITAN LIFE INSURANCE COMPANY IN NORTH CAROLINA FOR WEEK OF APRIL 17, 1916.

Age period	Males			Females		
	Total	Total exclusive of textile workers	Textile workers	Total	Total exclusive of textile workers	Textile workers
No. exposed	20,340	15,067	5,238	22,468	18,653	3,778
All ages	25.1	26.3	21.4	32.6	34.2	25.1
Under 15	15.3	15.6	10.1	14.8	14.8	15.1
15 to 24	15.8	20.0	11.7	24.8	25.2	24.2
25 to 34	22.6	22.1	23.3	36.7	38.5	28.7
35 to 44	28.1	31.4	21.4	55.0	56.7	41.5
45 to 54	42.8	48.1	30.0	58.8	60.8	22.5
55 to 64	70.1	67.8	76.6	75.0	77.5	22.2
65 and over	163.6	180.4	93.8	123.9	126.1	....

[1]This should be bobbins instead of shuttles.

This indicates that the sickness rate per thousand persons was at nearly every age period lower among the white textile workers than among the other white persons included in the survey. The conclusion reached by Doctors Frankel and Dublin, who conducted the survey, was that "no untoward conditions of sickness prevail in this industry as compared with the general group of the industrial classes enumerated in this survey."

Too much confidence must not be placed, however, on this single group of data, inasmuch as it covers conditions in a limited area for only one week. It does not necessarily follow that the relatively favorable results shown for textile workers are due to the industry. It suggests, however, that the health of southern cotton mill operatives is relatively favorable as compared with that of the industrial population in the same general section.

Leipzig Insurance Fund Data

Of less value, yet suggestive of the relative position of cotton mill workers from a health standpoint, are the well-known statistics of Leipzig, Germany. These statistics are based on a careful study of the reports of sickness from 1887 to 1904; in 1902 the membership in the fund included approximately 141,000 persons. Because of the considerable period which has elapsed since they were compiled, the statistics lose much of their original importance. Although conditions of industry, home life, and racial habits forbid their acceptance as representative of the same industries in the United States, they afford an opportunity for comparing health hazards in cotton manufacturing with those in other industries which may be assumed to have changed, to some extent at least, synchronously with the cotton industry itself. From Table 15, summarizing the Leipzig data, it appears that the health of the male textile mill workers as evidenced by the number of days of sickness per hundred members was considerably better than that of workers in a number of other industries listed, and that male weavers lost less time per 100 members than any other workers listed, save bookkeepers and accountants. For females, the experience was less favorable, but generally better than that for female workers in the other occupations here listed.

TABLE 15: AVERAGE NUMBER OF DAYS OF SICKNESS PER HUNDRED MEMBERS OF THE LOCAL SICK BENEFIT SOCIETY OF LEIPZIG, 1887–1904, BY LEADING OCCUPATIONS.[1]

Occupation	No. of days sickness per annum per 100 members	
	Males	Females
Iron and steel workers	1256	....
Metal polishers and grinders	1215	1456
Iron founders and machinists	1189	1666
Compositors and typesetters	1155	....
Hatters	1124	....
Hide industry workers	1123	1978
Tanners and leather dyers	1049	....
Rubber goods workers	1028	1494
Agricultural laborers	1020	1159
Blacksmiths	1002	....
Chemical industry workers	947	1342
Leather, artificial, and oilcloth workers	878	....
Textile mill workers	876	1229
Printers, lithographers, and pressmen	851	1130
Paper goods factory workers	827	1202
Electric apparatus factory workers	722	....
Lithographers	650	....
Boot and shoe makers and repairers	642	932
Lace factory workers	620	910
Weaving mill operatives	557	....
Bookkeepers and accountants	511	560

MORTALITY STATISTICS

Mortality rates are a dangerous criterion for the judgment of relative health hazards in that diagnosis and reporting of the causes of death are often faulty and records frequently are incomplete. In addition, attempts to compare the mortality of workers in various occupations is rendered especially difficult by the infrequency with which mortality by occupation is reported.

United States Census Data

In 1908 and 1909 the United States Census made a study of causes of death by occupation, which affords perhaps the best data on relative mortality at present available in this country. Table 16, compiled from the census data for 1909, shows the percentage of deaths from

[1]From "Diseases of Occupation and Vocational Hygiene," by Kober and Hanson, pp. 749–761 inc.

certain causes, by selected age groups, among male cotton mill workers, as compared with wage-earners in all manufacturing and mechanical pursuits combined.

TABLE 16: PERCENTAGE OF DEATHS OF MALES DUE TO CERTAIN CAUSES, FOR COTTON MILL OPERATIVES AND FOR WORKERS IN ALL MANUFACTURING AND MECHANICAL PURSUITS, BY AGE GROUPS. U. S. CENSUS MORTALITY STATISTICS, 1909.

CAUSE	25 to 34 years		35 to 44 years		45 to 54 years	
	Cotton mill operatives	All mfg. and mech.	Cotton mill operatives	All mfg. and mech.	Cotton mill operatives	All mfg. and mech.
Tuberculosis of the lungs	37.8	30.8	27.1	25.0	19.4	15.6
Heart disease	9.2	4.8	5.9	7.2	11.2	10.7
Apoplexy and paralysis	2.5	1.1	3.4	2.6	6.7	5.7
Bright's disease	3.4	3.8	7.6	6.5	8.2	9.6
Pneumonia	5.9	7.0	6.8	9.1	6.0	9.0
Cancer	1.7	1.5	4.2	3.6	8.2	6.6
Other diseases of the circulatory system	2.5	1.4	3.4	2.2	2.2	3.4
Other diseases of nervous system	3.4	2.2	0.8	2.7	1.5	2.6
Cirrhosis of the liver	0.8	0.8	4.2	1.9	3.0	2.8
Alcoholism	0.0	0.8	1.7	1.6	3.0	1.4
Diabetes	0.8	0.8	0.8	0.8	1.5	1.1
Typhoid fever	3.4	4.7	3.4	2.5	1.5	1.4
Occupational and chronic poisonings	0.0	0.1	0.0	0.2	0.0	0.1
Suicide	5.0	4.0	5.9	3.6	4.5	3.8
Accidents	6.7	20.8	10.2	15.6	3.7	10.1
Unclassified and unknown causes	16.8	15.7	14.7	14.7	19.3	7.3

From this table it appears that for certain leading causes the death rate among cotton mill workers is higher than it is among the industrial population in general. It is especially to be noted that the percentage of deaths from tuberculosis of the lungs was relatively higher in almost every instance for cotton mill operatives than the combined average for workers in all manufacturing and mechanical industries combined. The death rates from pneumonia and from accident, on the other hand, were relatively low.

However, it by no means follows that the industry itself is responsible for the conditions recorded. Nationality, inherited physique, personal habits and hygiene, and home conditions are of enormous importance in determining

the death rate, and it would be wholly unscientific to ascribe results to any one of these causes without considering the possible effects of all. For instance, it may easily be possible that the cotton industry, because of the lightness of the work, attracts a class of workers who do not have the strength and endurance demanded by many other occupations. This, however, is by no means a demonstrated fact. Again, the nationalities composing cotton operatives as a class may be exceptionally predisposed to such diseases as tuberculosis, so that the death rate among them from those diseases would be relatively high, regardless of the occupation in which they were found.

Reports of United States Bureau of Labor

The United States Bureau of Labor in a special investigation of the condition of woman and child wage-earners undertaken in response to an Act of Congress approved January 29, 1907, devoted one volume to the causes of death among such workers in cotton mills in Fall River, Mass., Pawtucket, R. I., and Manchester, N. H. Without attempting to set forth in detail either the methods or the results of this study, it may be noted that the evidence indicated a high death rate from tuberculosis among female operatives in cotton mills. For instance, this report, issued in 1912, stated:

> It seems impossible to escape the conclusion that operative work is prejudical to the health of females, that the combination of operative work with matrimony is especially harmful, and that, while the general hazard of the female operative is greater than that of the nonoperative, she is in most danger from tuberculosis. Whether the harmful effects of operative work are greater than those of other industrial employments, and whether they inhere in cotton textile work as a whole or are due to certain occupations carried on within the mills, are questions for further investigations to answer. This has established the fact of the high mortality among female cotton operatives and of their special susceptibility to tuberculosis.

The report, furthermore, stated:

> An examination of different factors which might affect the death rate, especially from tuberculosis, such as native or foreign birth, tuberculous kindred

> or intimates, overcrowding, sanitary conditions of homes, etc., fails to show any such massing of unfortunate conditions among the female operatives as would explain their unvaryingly higher death rate.

In a study of "Mortality from Consumption in Dusty Trades," published as a bulletin of the United States Bureau of Labor in 1908, Dr. Frederick L. Hoffman, statistician of the Prudential Life Insurance Company of America, took the ground that the mortality rate from tuberculosis among cotton mill workers, and among textile workers in general, was excessive. He cited various English statistics which indicated higher death rates among male operatives in cotton mills than among males in all occupations combined. The excess, as a rule, was most marked in the more advanced age groups; frequently the age groups under forty-four showed a death rate from tuberculosis rather lower than that for all occupied males. For spinners and weavers the British death rates were very much higher than those for all occupied males. Moreover, comparisons of the death rates in the United States, as furnished by industrial insurance company records, with the death rates for males as reported in the United States Census, indicated on the average that the death rate from tuberculosis among spinners was double the average for all males; a substantially similar excess was shown for weavers.

Dr. Hoffman's conclusions as to spinners were in part as follows:

> The mortality from consumption among spinners is known to be high, both among men and women, and no doubt, in a large measure this is the direct result of the employment. The degree of consumption frequency among spinners, however, is possible of a material reduction under satisfactory conditions of light, temperature, and ventilation. Modern American cotton mills, especially in the South, are in many respects more hygienic than the old type granite structures typical of New England. Compared with certain foreign countries, the mortality of cotton spinners, at least, would appear to be somewhat lower in the United States, due, no doubt, largely to the more recent development of the industry and the generally more satisfactory conditions of labor and life in this country.
>
> The preceding statistical data, including the industrial insurance mortality experience, confirm the

> conclusion that the mortality of spinners from consumption is considerably above the average throughout practically the entire active working period of life.

With respect to weavers, he concluded that the mortality from consumption is excessive at all ages.

The figures given for Great Britain, however, were in most cases for the years 1900 and 1902. Conditions in British mills at that time were radically different from those now prevailing in the United States. Again, the comparisons given for the United States were for periods from 1897 to 1906, since which time marked improvements in ventilation, dust-removing devices, and in other respects have been introduced.

SUMMARY OF HEALTH DATA

The evidence is, therefore, fairly convincing that tuberculosis is exceptionally prevalent among cotton mill workers, particularly for workers in certain processes, and that the death rate from this disease is relatively high. Furthermore, there is considerable evidence that this excess in the death rate is at least partly attributable to the industry itself. On the other hand, there is a tendency among students of tuberculosis to use increased caution in fixing the responsibility for its occurrence. This is not presented as an argument that the cotton manufacturing industry is not partly responsible for the wide prevalence of the disease among cotton mill operatives, but simply to show fairly the present diversity of scientific opinion on this important subject.[1]

The most significant fact brought out by these fragmentary data is that apparently there is no conclusive information as to the health hazards to which cotton mill operatives are exposed. The absence of satisfactory figures upon which to base conclusions is a powerful argument

[1] In this connection it may be noted that in a report of the United States Public Health Service upon tuberculosis among approximately 20,000 industrial workers in Cincinnati (Health Bulletin, No. 73, March, 1916) the general conclusion was reached that poverty, poor housing, and hereditary predisposition were more important factors than occupational hazards. In 204 hospital cases of tuberculosis specifically investigated, the conclusion was reached that "occupation *per se* has been a relatively unimportant factor." It should be noted that these 204 cases did not include any cotton mill operatives. They covered 75 occupations, however, although frequently there was only a single case of the disease for a given occupation.

for the keeping, by employers, of careful and complete records of all cases of illness among their employees. Indeed, unless such records are kept there is little prospect of reaching valuable conclusions as to the extent and particularly as to the causes of ill health among industrial workers.

ACCIDENT HAZARD IN THE COTTON INDUSTRY

The accident hazard in the cotton industry is rather low. In Massachusetts, where over 112,000 operatives are employed in the industry, only seven fatal accidents were reported by the state Industrial Accident Board for the year ending June 30, 1915, and of these only one could be ascribed to the industry itself. Of 7,214 non-fatal accidents reported, about one-third resulted in a disability of less than one day, and only two-fifths in disability of more than one week.

The following table, compiled from the Massachusetts Rate Manual of Compensation and Liability Insurance, compares the rates for cotton manufacturing with those for other industries.

TABLE 17: COMPARATIVE COMPENSATION AND LIABILITY INSURANCE RATES IN COTTON MANUFACTURING AND VARIOUS OTHER INDUSTRIES, IN MASSACHUSETTS, 1917.

Silk manufacturing	.29
Linotype and hand composition	.35
Boot and shoe manufacturing	.41
Cotton yarn manufacturing	.66
Printing	.66
Rubber boot and shoe manufacturing	.72
Wool spinning and weaving	.79
Cotton spinning and weaving	.88
Cloth printing	.97
Shoe findings manufacturing	1.00
Shoe stock manufacturing	1.16
Rubber tire manufacturing	1.28
Electric apparatus manufacturing	1.28
Machine shop, without foundry	1.47
Wool pulling	1.47
Wool scouring	1.47
Textile dyeing, finishing, and printing	1.59
Iron foundry	1.68
Wool combing	1.99
Steel castings	3.33
Rolling mills	3.33
Pulp manufacturing, sulphite process, no saw or barking mills	4.38
Saw and barking mills	6.64
Blast furnace operatives	6.95

This rating alone is reasonably convincing evidence that the accident hazard in the cotton manufacturing industry is comparatively low; this is not to say that it cannot be reduced. A low accident rate was also shown by the Census Statistics in Table 16.

In a later report it is intended to discuss the relationship between accidents and fatigue in industry. Considerable study of this problem has not as yet led to results which warrant conclusions.

SUMMARY AND CONCLUSIONS

Reductions in hours of work in northern cotton mills from 58 or 56 to 55 or 54 have in a great majority of cases resulted in a substantially proportional decrease in output. The fact of a decrease is indisputable. Because of the large number of influences involved, a precise measurement of the effect of any one is almost impossible, but the evidence establishes beyond a doubt that the reductions in hours were largely responsible. In some instances a part of the loss was promptly made up by increased efficiency of workers, but this experience was not general. Eventually improvements in equipment, in methods of management, and in other respects, often brought total output per employee up to that previously attained under a longer week. This, however, necessitated a material increase in investment.

Such limited data as are available for southern mills indicate that hours in excess of 60 per week do not necessarily yield a materially larger output than 60 hours. Reductions below a 60-hour schedule, however, usually resulted in substantial decreases in output.

There is no convincing evidence that a shortening of hours appreciably affected the morale or attitude of workers.

Where machine time controls to such an extent as in cotton manufacturing, comparisons of output under different hours-of-work schedules are not a reliable measure of changes in fatigue.

There is no available evidence of a significant difference in health conditions as between a 54-hour, a 56-hour, or a

58-hour schedule. Certain evidence indicates that the health of cotton mill workers is above that for industrial workers in general. Other evidence, equally important, indicates just the reverse. In particular, there is evidence of a relatively high occurrence of tuberculosis; the extent to which the industry itself is responsible, however, is not clear. Where results of careful investigation are so conflicting, it is obvious that still more extensive research must be undertaken before definite conclusions are warranted. Any scientific study of relative health conditions, moreover, must take account not merely of conditions associated with or inherent in the industry studied, but also of housing conditions, nationality, physical types, age, sex, and habits of the workers. It is hoped to secure data on these points for discussion in a later report covering various major industries.

Appendix

The following tables give the important data for those establishments which, in their replies to the Board's schedule of inquiries, stated the effects on output accompanying reductions in hours.

NORTHERN MILLS

PRODUCTION MAINTAINED

Reduced to 54 Hours

No. of Establishments . . 3
Total No. Employees . 2192

No. employees	Previous hours	Change in wages	Statement of Establishment
173[1]	55	No change in piece or weekly rates.	No noticeable change in output per employee or in labor cost. Employees welcomed the change.
87[2]	55	No change.	Better production or at least just as much as before. Employees better satisfied.
1932	56	Piece and hourly rates increased proportionally.	Piecework was not affected to any extent, as employees were able to produce practically the same amount as formerly, while dayworkers of course remained at about the same cost; would say that the loss on one was offset by the gain on the other.

Reduced to 55 Hours

No. of Establishments 3
Total No. Employees 3448

558	58	No change.	Production has been maintained and cost has not increased.
1470 (707 women reduced to 54 hours.)	60	Piece rates increased 10%.	Have not been able to note any direct effects.
1420	60	No change.	Did not seem to affect output or cost of production.

[1]Manufacturers of pile fabrics. See page 17.
[2]Manufacturers of Turkish towels.

PRODUCTION DECREASED

Reduced to 54 Hours

No. of Establishments 49
Total No. Employees 37,096

No. employees	Previous hours	Change in wages	Statement of Establishment
1348	56	No change.	Output decreased for both piece and time workers.
599	56	No change in piece or hourly rates.	Output per employee proportionately reduced, costs increased.
702	56	None.	No change in labor cost per unit of product, total output per employee decreased about 3½%.
389	56	Piece and hourly rates advanced proportionately.	Total output per employee 3% to 4% less, labor cost increased about 3%. Employees less efficient.
724	56	No change in piece or hourly rates.	In case of pieceworkers, total output per employee was reduced a small percentage less than the reduction in hours; in case of dayworkers the reduction in product was proportional to the reduction in time.
628	56	Increased 10%.	Output per employee decreased and labor cost increased 4%.
349	56	Increased proportionately.	Output per employee decreased and labor cost increased 3½%.
466	56	Wages increased.	Practically no change in output per employee or labor cost for piecework. For time work output decreased and costs increased.
755	56	Piece and hourly rates proportionately increased.	We do not see any improvement in the product per hour or the quality of work produced. Costs increased.
308	56	Piece and hourly rates advanced in proportion.	We do not see any improvement in the product per hour or the quality of work produced. Costs increased.
370	56	Wages increased 10%.	We find that the output in our plant varies about in proportion to the hours run. We cannot speed up or make changes in machinery to offset the reduced running time.
165	56	No change in piece or weekly rates.	Total output per employee decreased 3½%. Labor cost per unit increased for piecework 2%, for daywork 3½%. No other effect reported.
444	56	Hourly and piece rates raised 3½%. Speed of machinery increased 2%.	Total output per employee decreased 1½% and labor cost increased 1½%. Employees did less and poorer work.
57	56	No change in wages.	Output per employee decreased, and labor cost increased in direct proportion to hours worked.
637	56	10% increase in piece and hourly rates.	Output decreased 4%, labor cost increased 15%. No other change noted.

No. employees	Previous hours	Change in wages	Statement of Establishment
135	56	No change in weekly or piece rates.	Loss of output.
1174	56	Increased.	From standpoint of mill, change in hours resulted in less production and increased cost.
2234	56	No change.	Increased cost of production and lower factory output.
623	56	Reduction 3.57% in wages.	Decrease in production.
1095	56	10% increase in piece and hourly rates.	Output per employee decreased same percentage as reduction in hours. Costs increased; no other change perceptible.
532	56	No change.	Loss of production. Increase in cost.
375	56	No change in total wages.	Reduces our production and increases our cost accordingly.
327	56	No change in dayworkers; pieceworkers increased 3½%.	Reduction in production equal to reduction in hours.
504	56	No change.	Proportionally less product; higher costs.
863	56	No change.	Less production.
1041	56	No change in rate.	Loss of production.
1714	56	No change in piece or weekly rates.	A slight gain in production per hour by pieceworkers but not commensurate with the reduction of hours.
1616	56	Increased 10% to 15%.	Production is about in proportion to time machinery is operated.
233	56	Advanced proportionally.	Output decreased.
4751	56	Piece rates advanced 3½%, hourly rates unchanged.	Total output per employee decreased and labor costs increased. Attitude of employees not improved.
590	56	Advanced proportionally.	Output decreased.
2239	56	No change in piece or hourly rates.	See pages 37 to 39.
1077	58	No change in weekly rate.	No greater proportional output. Attitude of workers improved.
675	58	Piece and time rates advanced proportionately to reduction.	Additional cost was about 7½%. Labor more independent.
731	58	No change in weekly wages.	Loss of product. Desire for higher wages and less hours.
353	58	No change in day wages; piece wages proportionately increased.	Reduced our production approximately the same amount.
197	58	No change in piece or weekly rates.	Reduced production and increased cost.
513	58	Increased to offset reduction in hours.	New machinery and better routing system and some time clocks installed. Output per employee decreased and labor cost increased about 7%.

No. employees	Previous hours	Change in wages	Statement of Establishment
789	58	Wages advanced about 7.4%.	Less production and increased labor cost.
47	60		Less output but really better work. Improvement in health and attitude of employees.
667	60	Increased proportionately.	Production reduced about in proportion to reduction in hours.
1299	60	10% increase in piece and hourly rate.	Increased cost of production and decreased output about 10%. Employees better satisfied.
80	60	No change in dayworkers, piece rates increased.	Less production and increased cost of goods.
269	60	10% increase.	As regards the workers, noted no change in their physical condition or morale. As to cost, found that in departments where costs were governed by piecework the cost of production did not increase the full 10% due to shorter hours, about 8% covered the average increased cost, showing that pieceworkers improved their effort. With the dayworkers this did not obtain. Also note that our employees are absent more days than before change of hours and rate of wages.
116	60		Output per hour the same, but the 54-hour schedule worked out to our satisfaction, and our employees were also pleased with the new arrangement.
302	—	No change in hourly or piece rates.	Simply reduced wages, output, time, etc. in the proportion of hours reduced.
952	—		Output proportionately reduced.
617	—	No change in piece or hourly rate.	Loss of production and increased costs.
425	—	No change.	Loss in production.

Reduced to 55 Hours

No. of Establishments 13
Total No. of Employees 5070

355	58	No change in hourly rates; piece rates advanced 5%.	Total output per employee decreased 5%, and labor cost per unit of product increased 5%.
416	58	Increased proportionately.	Output decreased and costs increased.
291	58	Increased proportionately.	Output decreased 6%. Quality of work poorer. Labor cost increased 6%.
646	58	Increased proportionately.	Output decreased. Labor cost increased.
318	58	No change in piece or weekly rates.	Output decreased and labor cost increased about 5¼%.
197	58	No change in piece or hourly rates.	Loss in production of about 3% for pieceworkers and 5% for time workers.

No. employees	Previous hours	Change in wages	Statement of Establishment
361	58	No change in weekly rates; piece rates increased 5%.	Our product when last reduction in hours was made immediately decreased 6% and our labor cost increased 6%.
499	58	Proportional increase.	Less production, higher cost.
221	58	No change in day wages; piece rates increased 5%.	Production has been about the same per hour as before the reduction, or 5% less as a total than we were getting before.
415	58	Hourly and piece rates increased.	Output per employee decreased and labor cost increased about 2%.
135	58	Wages increased 8% to 10%.	Output per employee decreased 2%, labor cost increased 12%.
779	58		Costs increased.
437	60	Increased 5%.	Output per employee decreased 15%. Employees generally indifferent.

Reduced to 56 Hours

No. of Establishments 2
Total No. Employees 1379

1116	57	Increased 10%.	The output was cut down in about the same proportion.
263	58	Piece and hourly rates increased.	Total output per employee decreased and labor cost per unit of product increased .0345%. No other change noted.

SOUTHERN MILLS

PRODUCTION MAINTAINED

Reduced to 60 Hours

No. of Establishments 4
Total No. Employees 1797

No. employees	Previous hours	Change in wages	Statement of Establishment
432	64	No change.	No change.
598	66	No change.	We get as much production, if not more, after reducing to 60 hours weekly.
497	66	Piece rates increased.	No effect.
270	66		It seems to make the help more efficient, for they get better production now on the 10-hour basis than they used to get on the 11-hour basis.

PRODUCTION DECREASED

Reduced to 56 Hours

No. of Establishments 1
Total No. of Employees . . . . . over 1000

Over 1000	60		There has been no change thus far in rate of production, and the stoppage of four hours means that much production lost.

Reduced to 57 Hours

No. of Establishments 2
Total No. Employees 941

No. employees	Previous hours	Change in wages	Statement of Establishment
286	58	No change in wages.	Decreased production and increased costs.
655	58	No change in piece or weekly rates.	Small decrease in output, 2% increase in labor cost.

Reduced to 60 Hours

No. of Establishments 13
Total No. Employees 6326

745	62½	None.	Reduction of approximately 3% production per machine unit. Increase of cost of production of approximately the same percentage.
229	63	None.	Found output and cost about the same—but since, the cost has increased and production has decreased. Do not believe we are getting as good production per employee now as a year ago.
572	63	No change in piece rates. Same pay for 10 hours as for 10½.	Total output per employee decreased 2⅝%; 7% increase in labor cost.
212	63	No change in piece or hourly rates.	Total output per employee decreased 7% for both piece and day work. Labor cost increased 10%.
823	66	None.	Increase in cost of production.
355	66	No change in piece or weekly rates.	The help tried to maintain production on shorter hours as far as possible but production fell off 5% for pieceworkers and 7% for time workers.
350	66	No change.	No records available for percentage statements. Costs naturally went up but product did not drop 9% and general attitude and results were satisfactory to us.
250	66	None.	No noticeable change in total output per employee. Labor cost per unit of product increased 8%.
429	66		Total output per employee decreased 8 to 9%. Labor cost as before.
300	66	None.	Output same per hour. Labor cost per unit changed only in overhead.
1100	66	No change in piece or hourly rates.	Production was decreased about 8%.
809	67	No change in hourly or piece rates.	Output per employee decreased 10% and labor cost increased 12%.
152		Wages reduced with hours.	Decreased output and increased cost.